



Designation: F3476 – 21

Standard Guide for Airframe and Systems Aviation Maintenance Personnel¹

This standard is issued under the fixed designation F3476; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 The purpose of this guide primarily is to address the fundamental subject knowledge, task performance, and task knowledge activities labeled “Airframe and Systems,” which ensures the Aircraft Maintenance Technician (AMT)/Aircraft Maintenance Engineer (AME) have the necessary basic knowledge and skills for today’s global aviation maintenance environment. Thus, the ASTM F46 Aerospace Personnel Committee has developed academic and skills knowledge standards that have been developed by aerospace industry-lead working groups. These standards reflect industry best practices and provide a focus on levels of safety that may exceed current regulatory guidance for aircraft maintenance technician academic and skills standards. This guide may supplement a state’s basic general requirements for AMT/AME certification. It is not the intent of this guide to replace the AMT requirements, but to ensure the AMT/AME is trained to the level as indicated. It is recommended that ASTM F3376, Standard Guide for Core Competencies for Aviation Maintenance Personnel, be used as a prerequisite for this guide. This guide may be used as a basis for an approval when specifically identified as such by the appropriate governing authority.

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.*

¹ This guide is under the jurisdiction of ASTM Committee F46 on Aerospace Personnel and is the direct responsibility of Subcommittee F46.03 on Airframe and Systems Endorsements.

Current edition approved Oct. 15, 2021. Published November 2021. DOI: 10.1520/F3476-21.

2. Referenced Documents

2.1 *ASTM Standards:*²

F3060 Terminology for Aircraft

F3376 Guide for Core Competencies for Aviation Maintenance Personnel

2.2 *Advisory Document:*³

14 CFR Part 1 Definitions and Abbreviations

3. Terminology

3.1 *Definitions*—See 14 CFR Part 1, Definitions and Abbreviations.

3.2 *Definitions*—See ASTM F3060, Standard Terminology for Aircraft.

3.3 *Acronyms and Abbreviations:*

3.3.1 *ADF*—automatic direction finder

3.3.2 *APU*—auxiliary power unit

3.3.3 *BITE*—built-in test equipment

3.3.4 *DME*—distance measuring equipment

3.3.5 *ELT*—emergency locator transmitter

3.3.6 *ICA*—instructions for continued airworthiness

3.3.7 *ILS*—instrument landing system

3.3.8 *MSG3*—maintenance steering group, 3rd generation

3.3.9 *PMA*—parts manufacturing approval

3.3.10 *RVSM*—reduced vertical separation minimum

3.3.11 *STC*—supplemental type certificate

3.3.12 *TCAS*—traffic alert collision avoidance system

3.3.13 *TSO*—technical standard order

3.3.14 *VHF*—very high frequency

3.3.15 *VOR*—VHF omni-directional ranging

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

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

3.4 See **Table 1** for explanations for task knowledge and subject knowledge levels.

4. Significance and Use

4.1 This industry developed standard is to be used in conjunction with AMT/AME curriculum programs to help ensure enhanced knowledge and skill levels for the maintenance technician/engineer in today’s ever-changing and highly technical aviation environment.

4.2 Task requirements are divided by Air Transport Association of America (ATA) category and listed in ATA order.

4.3 If a task is only listed as Level 3, it is understood the task will require knowledge at Level 1 and Level 2 as well.

4.4 Advanced, specific, or specialized knowledge standards may be developed in future endorsements. Aircraft model specific courses and aircraft painting are examples of endorsement areas.

5. Knowledge and Task Requirements

5.1 See **Table 1** for detailed explanations of Levels 1, 2, and 3.

5.2 (ATA 5) *Aircraft Inspection and Conformity – LEVEL 1*—Understands and can describe the following:

5.2.1 Certification categories (type certification, production certification, airworthiness certification).

5.2.2 Products and parts, Supplemental Type Certificate (STC), Parts Manufacturing Approval (PMA), Technical Standard Order (TSO).

5.2.3 Time limited maintenance, Maintenance Steering Group, 3rd Generation (MSG3), Instructions for Continued Airworthiness (ICA), airworthiness limitations.

5.3 *Airworthiness Requirements for Structural Strength – LEVEL 2*—Understands and can apply the theory related to the following:

5.3.1 Classification of structures (primary, secondary, and tertiary).

5.3.2 Inspections using borescope and remote electronic methods.

5.4 *Airworthiness Definition and Application – LEVEL 2*—Understands and can apply the theory related to the following:

5.4.1 Airframe conformity inspection.

5.4.2 Special inspections (heavy landing, lightning strikes).

5.4.3 Airworthiness requirements.

5.5 (ATA 6) *Dimensions and Areas – LEVEL 1*—Understands and can describe the following:

5.5.1 Aircraft Dimensions (wingspan, length, height, measurement references).

5.5.2 Areas and Zones.

5.6 (ATA 7) *Lifting and Shoring – LEVEL 1*—Understands and can describe the following:

5.6.1 Sling or trestle major component.

5.7 *Lifting and Shoring – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.7.1 Aircraft jacking.

5.8 (ATA 8) *Leveling and Weighing – LEVEL 2*—Understands and can apply the theory related to the following:

5.8.1 Configuration of aircraft against equipment list.

5.8.2 Preparation, leveling, and weighing aircraft.

5.9 (ATA 12) *Servicing - Routine Maintenance – LEVEL 1*—Understands and can describe the following:

5.9.1 Fueling and defueling.

5.9.2 Tire pressure checks.

5.9.3 Servicing of oil, hydraulic fluid, accumulators, and pneumatic systems.

TABLE 1 Knowledge and Task Levels

LEVEL 1	A familiarization with the principal elements of the subject. Objectives: <ul style="list-style-type: none"> • The student should be familiar with the basic elements of the subject. • The student should be able to give a simple description of the entire subject. • The student should be able to locate methods, procedures, instructions, and reference material. • The student should be able to use typical terms. • No skill demonstration is required under this level.
LEVEL 2	A general knowledge of the theoretical and practical aspects of the subject, and an ability to apply that knowledge in a practical manner. Objectives: <ul style="list-style-type: none"> • The student should be able to find and interpret maintenance data and information. • The student should be able to give a general description of the subject using, as appropriate, typical examples. • The student should be able to use mathematical formulae in conjunction with physical laws describing the subject. • The student should be able to read and understand sketches, drawings, and schematics describing the subject. • A high level of skill is not required.
LEVEL 3	A detailed knowledge of theoretical and practical aspects of the subject. To know, understand, and apply facts, principles, theories, and concepts. Objectives: <ul style="list-style-type: none"> • The student should be able to give a detailed description of the subject using theoretical fundamentals and specific examples. • The student should be able to apply their knowledge in a practical manner using manufacturer’s or other acceptable data. • The student should be able to interpret results from various sources and measurements and apply corrective action where appropriate. • Perform all skill operations to a return-to-service standard using appropriate data, tools, and equipment. • The student should be able to perform inspections in accordance with acceptable or approved data. • A high level of skill is required.

5.9.4 Servicing grease-fitted components and other areas that require grease.

5.9.5 Use of ground power.

5.9.6 Servicing water and toilet systems.

5.9.7 Verification of fluid levels during preflight checks.

5.10 (ATA 20) *Standard Practices (Basic) – LEVEL 1*—Understands and can describe the following:

5.10.1 Soldering, brazing, and welding techniques using Oxy-Acetylene gas, Shield Metal Arc (SMAW), Metal Inert Gas (MIG), and Tungsten Inert Gas (TIG).

5.10.2 Identification and use of digital databus systems.

5.11 *Standard Practices (Intermediate) – LEVEL 2*—Understands and can apply the theory related to the following:

5.11.1 Identification of pipes and unions.

5.11.2 Soldering of stainless steel and copper/bronze materials.

5.11.3 Fabrication of tubular structures.

5.11.4 Inspection of aluminum, steel, and stainless steel welds.

5.11.5 Inspection of magnesium and titanium welds.

5.11.6 Understand fail safe, life limits, and damage tolerance concepts.

5.11.7 Inspection and repair of aircraft electrical system components (crimp and splice wiring to manufacturer's specifications, repair of pins and sockets of aircraft connectors).

5.11.8 Inspection and testing of proximity switches and printed circuit boards.

5.11.9 Understand and use of Built-In Test Equipment (BITE).

5.12 *Standard Practices (Advanced) – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.12.1 Torque applications.

5.12.2 Installation, testing, and servicing of airframe electrical wiring, controls, switches, indicators, and protective devices.

5.13 (ATA 21) *Air Conditioning and Pressurization Systems:*

5.13.1 *Air Conditioning and Pressurization Systems Theory of Operation – LEVEL 1*—Understands and can describe the following:

5.13.1.1 Air conditioning and air conditioning systems.

5.13.1.2 Air cycle and vapor cycle machines.

5.13.1.3 Air distribution systems.

5.13.1.4 Air flow, temperature, and humidity control systems..

5.13.1.5 Pressurization and pressurization systems.

5.13.1.6 Control and indication systems, including outflow control and safety valves.

5.13.1.7 Cabin pressure controllers.

5.13.1.8 Safety and warning devices.

5.13.2 *Air Conditioning and Pressurization Systems Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.13.2.1 Inspection, testing, troubleshooting, servicing, and repair of air conditioning systems, pressurization systems, air cycle and air vapor machines.

5.14 (ATA 22) *Autoflight System:*

5.14.1 *Autoflight System Theory of Operation – LEVEL 1*—Understands and can describe the following:

5.14.1.1 Autoflight systems including auto-throttle and auto-brake systems.

5.14.2 *Autoflight System Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.14.2.1 Inspection, testing, and troubleshooting of autopilot, servos, and approach coupling systems.

5.15 (ATA 23) *Communication Systems:*

5.15.1 *Communication Systems Theory of Operation – LEVEL 1*—Understands and can describe the following:

5.15.1.1 Communication Systems including High Frequency (HF), Very High Frequency (VHF), Satellite Communication (SATCOM), Passenger Address (PA), and Interphone/Intercom.

5.15.1.2 Emergency Locator Transmitter (ELT) awareness to prevent false activation.

5.15.2 *Communication Systems Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.15.2.1 Inspection, testing, troubleshooting, and repair of communication systems and antennas.

5.16 (ATA 24) *Electrical Power System:*

5.16.1 *Electrical Power System Theory of Operation – LEVEL 1*—Understands and can describe the following:

5.16.1.1 DC power generation.

5.16.1.2 AC power generation.

5.16.1.3 Emergency power generation.

5.16.1.4 Voltage regulation.

5.16.1.5 Power distribution.

5.16.1.6 Inverters, transformers, and rectifiers.

5.16.1.7 Circuit protection.

5.16.1.8 External power and ground power.

5.16.2 *Electrical Power System Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

5.16.2.1 Inspection, testing, troubleshooting, servicing, and repair of alternating and direct-current electrical systems.

5.16.2.2 Inspection, testing, and troubleshooting of constant speed and integrated drive generators.

5.16.2.3 Inspection, installation, and servicing of aircraft batteries (all types).

5.17 (ATA 25) *Equipment and Furnishings:*

5.17.1 *Equipment and Furnishings General Knowledge – LEVEL 1*—Understands and can describe the following:

5.17.1.1 Identification of interior burn certification requirements.

5.17.1.2 Cabin lay-out.

5.17.1.3 Cabin equipment lay-out.

5.17.1.4 Cabin furnishings installation.

5.17.1.5 Cabin entertainment equipment.

5.17.1.6 Galley installations.

5.17.1.7 Cargo handling and retention equipment.

5.17.1.8 Air stairs and main entry doors.

5.17.2 *Equipment and Furnishings Installations and Requirements – LEVEL 2*—Understands and can apply the theory related to the following:

- 5.17.2.1 Emergency equipment requirements.
- 5.17.2.2 Seats, harnesses, seat belts, and seat installations.
- 5.17.2.3 Cargo loading systems.

5.18 *(ATA 26) Fire Protection System:*

5.18.1 *Fire Protection System Theory of Operation – LEVEL 1*—Understands and can describe the following:

- 5.18.1.1 Fire and smoke detection and warning systems.
- 5.18.1.2 Fire extinguishing systems and system tests.

5.18.2 *Fire Protection System Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

- 5.18.2.1 Inspection, testing, servicing, troubleshooting, and repair of aircraft fire detection and extinguishing systems.
- 5.18.2.2 Inspection and servicing of portable fire extinguishers.

5.19 *(ATA 27) Flight Control System:*

5.19.1 *Flight Control System Theory of Operation – LEVEL 1*—Understands and can describe the following:

- 5.19.1.1 Cable and pulley systems.
- 5.19.1.2 Hydraulic systems.
- 5.19.1.3 Fly-by-Wire systems.

5.19.2 *Flight Control System Installation and Requirements – LEVEL 2*—Understands and can apply the theory related to the following:

- 5.19.2.1 Flight control surface construction and attachment.
- 5.19.2.2 Rigging of mechanical and electric-hydro flight control systems in fixed-wing aircraft.
- 5.19.2.3 Rigging of mechanical and electric-hydro control systems in rotary-wing aircraft.
- 5.19.2.4 Effects of wing fences and sawtooth leading edges.

5.19.3 *Flight Control System Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

- 5.19.3.1 Assembly of aircraft components including flight control surfaces.
- 5.19.3.2 Balancing, rigging, and inspection of movable primary and secondary flight control surfaces.
- 5.19.3.3 Operation and effect of roll control including ailerons and spoilers.
- 5.19.3.4 Operation and effect of pitch control including elevators, stabilators, variable incidence stabilizers, and canards.
- 5.19.3.5 Operation and effect of yaw control including rudder and rudder limiters, elevons, and ruddervators.
- 5.19.3.6 Operation and effect of high-lift devices including slots, slats, flaps, and flaperons.
- 5.19.3.7 Operation and effect of drag inducing devices including spoilers, lift dumpers, and speed brakes.
- 5.19.3.8 Effect of boundary layer control using vortex generators, stall wedges, leading edge devices.
- 5.19.3.9 Operation and effect of trim tabs including balance and anti-balance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, and aerodynamic balance panels.
- 5.19.3.10 System operation of manual, hydraulic, pneumatic, electrical, and fly-by-wire flight controls.

5.19.3.11 Operation of artificial feel, yaw damper, mach trim, and rudder limiter.

- 5.19.3.12 Operation of flight control locking systems.
- 5.19.3.13 Operation of stall protection/warning systems.

5.20 *(ATA 28) Fuel Systems:*

5.20.1 *Fuel Systems Theory of Operation – LEVEL 1*—Understands and can describe the following:

- 5.20.1.1 Fuel system architecture.
 - 5.20.1.2 Fuel tanks and bladders.
 - 5.20.1.3 Fuel supply systems.
 - 5.20.1.4 Fuel dumping, venting, and draining.
 - 5.20.1.5 Fuel cross-feed and transfer.
 - 5.20.1.6 Fuel quantity and temperature indicating and warning systems.
 - 5.20.1.7 Refueling and defueling.
 - 5.20.1.8 Lateral and longitudinal balance of fuel systems.
- 5.20.2 *Fuel Systems Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:
- 5.20.2.1 Operation, testing, troubleshooting, servicing, and repair of fuel pressure and temperature warning systems.
 - 5.20.2.2 Testing and servicing of fuel dump systems.
 - 5.20.2.3 Fuel management transfers and defueling.
 - 5.20.2.4 Inspection, testing, and repair of pressure fueling systems.
 - 5.20.2.5 Inspection, testing, servicing, troubleshooting, and repair of aircraft fuel systems.

5.21 *(ATA 29) Hydraulic Power System:*

5.21.1 *Hydraulic Power System Theory of Operation – LEVEL 1*—Understands and can describe the following:

- 5.21.1.1 Hydraulic system architecture.
- 5.21.1.2 Types of hydraulic fluids.
- 5.21.1.3 Servicing of hydraulic reservoirs and accumulators.
- 5.21.1.4 Types of pressure generation (electric, mechanical, pneumatic).
- 5.21.1.5 Emergency pressure generation.
- 5.21.1.6 Hydraulic pressure control.
- 5.21.1.7 Hydraulic power distribution.
- 5.21.1.8 Hydraulic indication and warning systems.
- 5.21.1.9 Hydraulic system integration with other systems.

5.21.2 *Hydraulic Power System Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following:

- 5.21.2.1 Inspection, servicing, troubleshooting, and repair of hydraulic systems.

5.22 *(ATA 30) Ice and Rain Protection Systems:*

5.22.1 *Ice and Rain Protection Systems Theory of Operation – LEVEL 1*—Understands and can describe the following:

- 5.22.1.1 Ice formation, classification, and detection.
- 5.22.1.2 De-icing systems (electrical, hot air, pneumatic, and chemical).
- 5.22.1.3 Rain repellent systems.
- 5.22.1.4 Probe and drain heating.
- 5.22.1.5 Wiper systems.

5.22.2 *Ice and Rain Protection Systems Maintenance – LEVEL 3*—Can describe in detail and perform tasks related to the following: