AIRCRAFT TECHNICAL BOOK COMPANY

B1

AVIATION MAINTENANCE TECHNICIAN CERTIFICATION SERIES

MAINTENANCE PRACTICES

7

COMPLIANT WITH EASA

EASA PART 66/147

EASA 2023-989 COMPLIANT

REVISION LOG

Update notices for this book will be available online at www.actechbooks.com/revisions.html
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VERSION	EFFECTIVE DATE	DESCRIPTION OF REVISION(S)
001	2016.01	Module creation and release.
002	2016.08	Format update and minor content revisions.
003	2019.10	Refined content sequencing to Appendix 1.
003.1	2021.10	Corrected description of file types (Submodule 7, pages 3.15-3.16).
003.2	2023.04	Submodule 8 - Added content on *Friction* and *Mechanical lock blind rivet* procedures.
004	2024.01	Regulatory update for EASA 2023-989 Compliance.
004.1	2024.07	Included missing Figures from Submodule 3 (3-136 and 3-137). Corrected sequence of Figures 3-117 and 3-118. Additional typo errors fixed.
004.2	2025.01	Page 5.9 - Corrected orientation of Figure 5-10B. Page 5.25 - Corrected y axis identifier for Figure 5-36. Page 12.3 - Corrected orientation of checknuts Figure 12-9.

Module was reorganized based upon the EASA 2023-989 subject criteria. Enhancements included in this version 004.2 are:

7.1 *Fuel Tank Safety* - topic added.
7.1 *Ballistic Parachutes* - topic added.
7.4 *Avionics Test Equipment* - topic moved to Modules 11, 12, and 13 per 2023-989.
7.7 *Connector Pin Wire Support* - topic added.
7.7 *Soldering Electrical Wires* - topic added.
7.7 *HIRF Protection Principles* - topic added.
7.8 *Special Purpose Rivets and Fasteners* - topic added.
7.9 *Visual Inspection of Springs* - topic added.
7.9 *Inspecting Squareness of Springs* - topic added.
7.13 *Cable Tension Regulators* - topic added.
7.13 *Cable Guides and Adjustment* - topic added.
7.14 *Additive Manufacturing* - topic added.
7.15 *Welding* - submodule deleted per 2023-989.
7.18 *Structural Repair Manuals* - topic added.
7.18 *Dye Penetrant Color Contrast* - topic added.
7.19 *HIRF Test Equipment* - topic added.
7.21 *Documentation and Communication* - new submodule added.

MEASUREMENT STANDARDS

SI Units
The measurements used in this book are presented with the International System of Units (SI) standards in all cases except when otherwise specified by ICAO (for example, altitude expressed in feet or performance numbers as specified by a manufacturer). The chart below can be used should your studies call for conversions into imperial numbers.

Number Groups
This book uses the International Civil Aviation Organization (ICAO) standard of writing numbers. This method separates groups of 3 digits with a space, versus the European method by periods and the American method by commas.

For example, the number one million is expressed as:

ICAO Standard	1 000 000
European Standard	1.000.000
American Standard	1,000,000

Prefixes
The prefixes used in the table below form names of the decimal equivalents in SI units.

PREFIX AND SYMBOLS CHART

MULTIPLICATION FACTORS	PREFIX	SYMBOL
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deca	da
0.1 = 10^{-1}	deci	d
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	µ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

COMMON CONVERSIONS CHART

IMPERIAL	TO	SI (METRIC)	SI (METRIC)	TO	IMPERIAL
Distance			**Distance**		
1 Inch	is equal to	2.54 Centimeters	1 Centimeter	is equal to	0.394 Inches
1 Foot	is equal to	0.304 Meters	1 Meter	is equal to	3.28 Feet
1 (Statute) Mile	is equal to	1.609 Kilometers	1 Kilometer	is equal to	0.621 Miles
Weight			**Weight**		
1 Pound	is equal to	0.454 Kilograms	1 Kilogram	is equal to	2.204 Pounds
Volume			**Volume**		
1 Quart	is equal to	0.946 Liters	1 Liter	is equal to	1.057 Quarts
1 Gallon	is equal to	3.785 Liters	1 Liter	is equal to	0.264 Gallons
Temperature			**Temperature**		
°0 Fahrenheit	is equal to	-17.778 Celsius (°C)	°0 Celsius (°C)	is equal to	33.8° Fahrenheit
°0 Fahrenheit	is equal to	255.37 Kelvin (K)	°0 Kelvin (K)	is equal to	-459.67 Fahrenheit
Area			**Area**		
1 Square Inch	is equal to	6.451 Square Centimeters	1 Square Centimeter	is equal to	0.155 Square Inches
1 Square Foot	is equal to	0.093 Square Meters	1 Square Meter	is equal to	10.764 Square Feet
1 Square Mile	is equal to	2.59 Square Kilometers	1 Square Kilometer	is equal to	0.386 Square Miles
Velocity			**Velocity**		
1 Foot Per Second	is equal to	0.304 Meters Per Second	1 Meter Per Second	is equal to	3.281 Feet Per Second
1 Mile Per Hour	is equal to	1.609 Kilometers Per Hour	1 Kilometer Per Hour	is equal to	0.621 Miles Per Hour
1 Knot	is equal to	1.852 Kilometers Per Hour	1 Kilometer Per Hour	is equal to	0.540 Knots

Pressure		
pounds per square inch (psi)	kiloPascals (kPa)	6.897
pounds per square inch (psi)	Pascals (Pa)	6.894

BASIC KNOWLEDGE REQUIREMENTS

Qualification on basic subjects for each aircraft maintenance license category or subcategory is accomplished in accordance with the following matrix. Where applicable, subjects are indicated by an "**X**" in the column below the license heading.

EASA LICENSE CATEGORY CHART MODULE NUMBER AND TITLE		A1 Airplane Turbine	B1.1 Airplane Turbine	B1.2 Airplane Piston	B1.3 Helicopter Turbine	B1.4 Helicopter Piston	B2 Avionics
1	Mathematics	X	X	X	X	X	X
2	Physics	X	X	X	X	X	X
3	Electrical Fundamentals	X	X	X	X	X	X
4	Electronic Fundamentals		X	X	X	X	X
5	Digital Techniques, Electronic Instrument Systems	X	X	X	X	X	X
6	Materials and Hardware	X	X	X	X	X	X
7	Maintenance Practices	X	X	X	X	X	X
8	Basic Aerodynamics	X	X	X	X	X	X
9	Human Factors	X	X	X	X	X	X
10	Aviation Legislation	X	X	X	X	X	X
11	Aeroplane Aerodynamics, Structures and Systems	X	X				
12	Rotorcraft Aerodynamics, Structures and Systems				X	X	
13	Aircraft Aerodynamics, Structures and Systems						X
14	Propulsion						X
15	Gas Turbine Engine	X	X		X		
16	Piston Engine			X		X	
17	Propeller	X	X	X			

Basic knowledge requirments as outlined in Part-66, Appendix I

The knowledge level indicators are defined on 3 levels as follows:

Level 1

A familiarization with the principal elements of the subject.

Objectives:

a. The applicant should be familiar with the basic elements of the subject.
b. The applicant should be able to give a simple description of the whole subject, using common words and examples.
c. The applicant should be able to use typical terms.

Level 2

A general knowledge of the theoretical and practical aspects of the subject and an ability to apply that knowledge.

Objectives:

a. The applicant should be able to understand the theoretical fundamentals of the subject.
b. The applicant should be able to give a general description of the subject using, as appropriate, typical examples.
c. The applicant should be able to use mathematical formula in conjunction with physical laws describing the subject.
d. The applicant should be able to read and understand sketches, drawings and schematics describing the subject.
e. The applicant should be able to apply his knowledge in a practical manner using detailed procedures.

Level 3

A detailed knowledge of the theoretical and practical aspects of the subject and a capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner.

Objectives:

a. The applicant should know the theory of the subject and interrelationships with other subjects.
b. The applicant should be able to give a detailed description of the subject using theoretical fundamentals and specific examples.
c. The applicant should understand and be able to use mathematical formula related to the subject.
d. The applicant should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.
e. The applicant should be able to apply his knowledge in a practical manner using manufacturer's instructions.
f. The applicant should be able to interpret results from various sources and measurements and apply corrective action where appropriate.

PART 66 BASIC KNOWLEDGE REQUIREMENTS

SUBMODULE KNOWLEDGE DESCRIPTIONS		LEVEL
		B1
7.1	**Safety Precautions – Aircraft and Workshop** Aspects of safe working practices including precautions to be taken when working with electricity, gases (especially oxygen), oils, and chemicals. Fuel tank safety, fuel tank entry procedures and precautions. Awareness and precautions regarding aircraft equipped with ballistic recovers systems. Also, instructions in the remedial action to be taken in the event of a fire or another accident with one or more of these hazards including knowledge of fire extinguishing agents.	3
7.2	**Workshop Practices** Care of tools / drills and reamers, control of tools, use of workshop materials; Dimensions, allowances and tolerances, workmanship standards; Calibration of tools and equipment, calibration standards.	3
7.3	**Tools** Common hand-tool types; Common power-tool types; Operation and use of precision-measuring tools; Lubrication equipment and methods; Operation, function, and use of electrical general test equipment.	3
7.4	**Submodule reserved for future use.**	–
7.5	**Engineering Drawings, Diagrams, and Standards** Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identification of title block information; Microfilm, microfiche, and computerised presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including ISO, AN, MS, NAS and MIL; Wiring diagrams and schematic diagrams.	2
7.6	**Fits and Clearances** Drill sizes for bolt holes, classes of fits; Common system for fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings, and other parts.	2
7.7	**Electrical Wiring Interconnection System (EWIS)** Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Coaxial cables: testing and installation precautions; Identification of wire types, their inspection criteria and damage tolerance; Wiring protection techniques: cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding; High-Intensity Radiated Fields (HIRF) and protection principles; Soldering of electrical wires, EWIS installations, inspection, repair, maintenance, and cleanliness standards.	3
7.8	**Riveting** Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.	2
7.9	**Pipes and Hoses** Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.	2
7.10	**Springs** Inspection and testing of springs.	2
7.11	**Bearings** Testing, cleaning and inspection of bearings; Lubrication requirements for bearings; Defects in bearings and their causes.	2
7.12	**Transmissions** Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push–pull rod systems.	2

SUBMODULE KNOWLEDGE DESCRIPTIONS		LEVEL
		B1
7.13	**Control Cables** Swaging of end fittings; Inspection and testing of control cables; Bowden cables; aircraft flexible control systems.	2
7.14	**Material Handling**	
7.14.1	**Sheet Metal** Marking out and calculation of bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.	2
7.14.2	**Composite and Non-metallic** Bonding practices; Environmental conditions; Inspection methods.	2
7.14.3	**Additive Manufacturing** Common additive manufacturing techniques and their influence on the mechanical properties of the finished part; Inspection of additive manufactured parts and common production failures.	1
7.15	**Submodule reserved for future use.**	–
7.16	**Aircraft Weight and Balance** (a) Calculation of centre-of-gravity / balance limits: use of relevant documents. (b) Preparation of aircraft for weighing; Aircraft weighing.	2 2
7.17	**Aircraft Handling and Storage** Aircraft taxiing/towing and associated safety precautions; Aircraft jacking, chocking, securing and associated safety precautions; Aircraft storage methods; Refuelling/defuelling procedures; De-icing/anti-icing procedures; Electrical, hydraulic, and pneumatic ground supplies; Effects of environmental conditions on aircraft handling and operation.	2
7.18	**Disassembly, Inspection, Repair, and Assembly Techniques** (a) Types of defects and visual inspection techniques; Corrosion removal, assessment and reprotection; (b) General repair methods, structural repair manual; Ageing, fatigue, and corrosion control programmes; (c) Non-destructive inspection techniques including penetrant, radiographic, eddy current, magnetic particle, ultrasonic and borescope inspections; including practical training in colour contrast penetrant inspection; (d) Disassembly and reassembly techniques; (e) Troubleshooting techniques.	3 2 2 2 2
7.19	**Abnormal Events** (a) Inspections following lightning strikes and HIRF penetration; (b) Inspections following abnormal events such as heavy landings and flight through turbulence.	2 2
7.20	**Maintenance Procedures** Maintenance planning; Modification procedures; Stores procedures; Certification/release procedures; Interface with aircraft operation; Maintenance Inspection / Quality Control / Quality Assurance; Additional maintenance procedures; Control of life-limited components.	2
7.21	**Documentation and Communication** Documentation: elements and criteria for writing work reports, troubleshooting reports, and shift handover instructions. Communication: clear, comprehensive, and concise.	2

MAINTENANCE PRACTICES

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The method of operation of dry powder fire extinguishers varies from gas cartridge charges, or stored pressure within the container which forces the powder charge out of the container, to tossing the powder on the fire by hand, by scooping pails or buckets of the powder from large containers or barrels.

Dry powder is not recommended for aircraft use (except on metal fires as a fire extinguisher) because the leftover chemical residues and dust often make cleanup difficult, and can damage electronic or other delicate equipment.

IDENTIFYING FIRE EXTINGUISHERS

Fire extinguishers should be marked to indicate suitability for a particular class of fire. The markings on **Figure 1-16** should be placed on the fire extinguisher and in a conspicuous place in the vicinity of the fire extinguisher. When the location is marked, however extreme care must be taken to ensure that the fire extinguisher kept at that location is in fact the type depicted by the marking. In other words, if a location is marked for a Class B fire extinguisher, ensure that the fire extinguisher in that location is in fact suitable for Class B fires. Markings should be applied by decalcomanias (decals), painting, or similar methods. They should be legible and as durable as necessary for the location. For example, markings used outside need to be more durable than those in the hangar or office spaces.

Where markings are applied to the extinguisher, they should be located on the front of the shell (if one is installed) above or below the extinguisher nameplate. Markings should be large enough and in a form that is easily seen and identifiable by the average person with average eyesight at a distance of at least 3 feet.

Where markings are applied to wall panels, and so forth, in the vicinity of extinguishers, they should be large enough and in a form that is easily seen and identifiable by the average person with average eyesight, at a distance of at least 25 feet. [**Figure 1-17 and 1-18**]

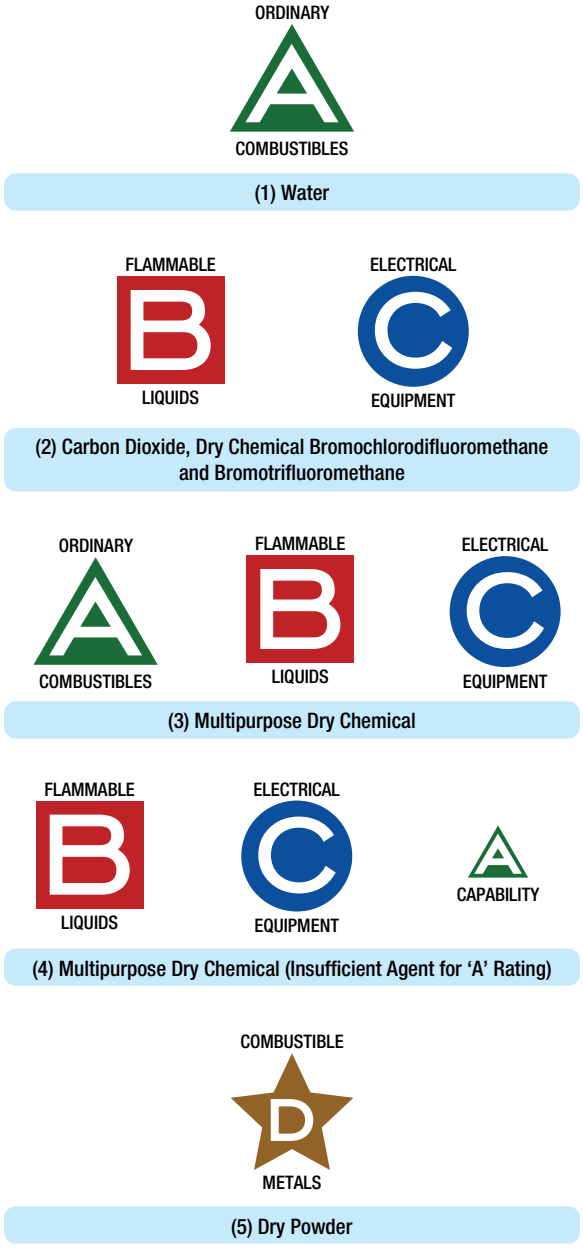

Figure 1-16. Typical extinguisher markings.

INSPECTION OF FIRE EXTINGUISHERS

Fire extinguishers should be checked periodically using a checklist. If a checklist is unavailable, check the following as a minimum:

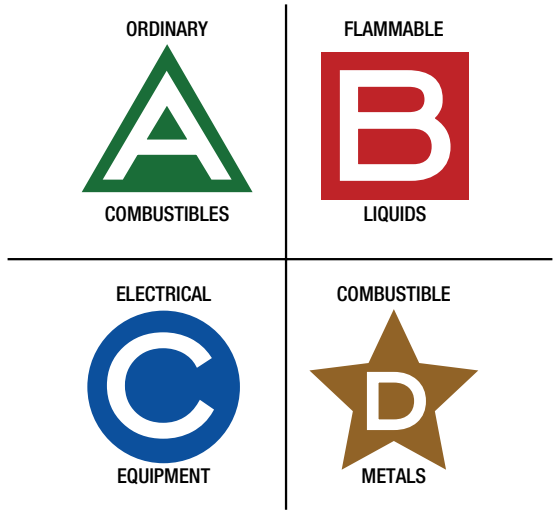

Figure 1-17. United States identification codes of fire extinguishers.

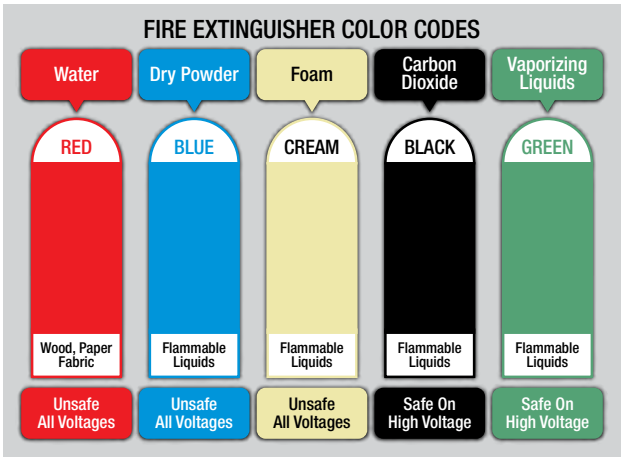

Figure 1-18. European and Australian identification codes of fire extinguishers.

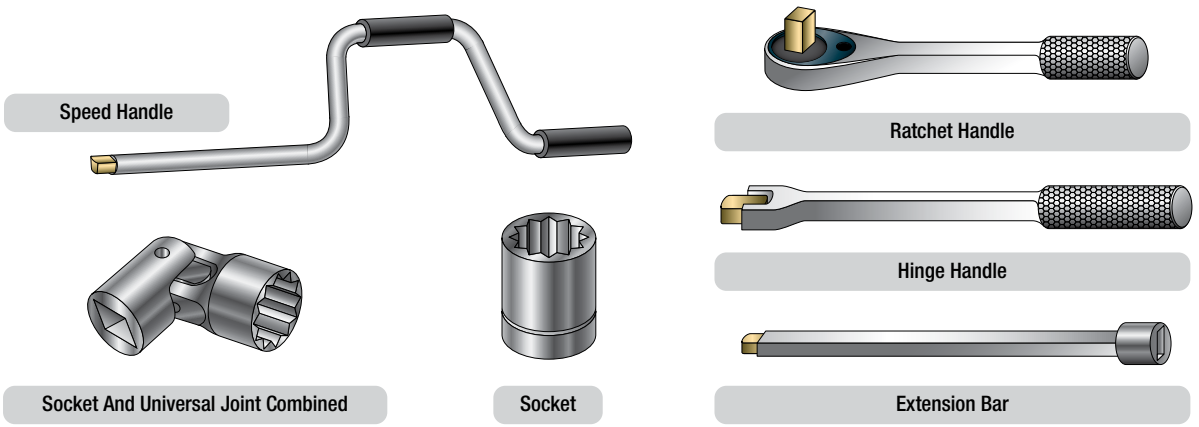

Figure 3-10. Socket wrench set.

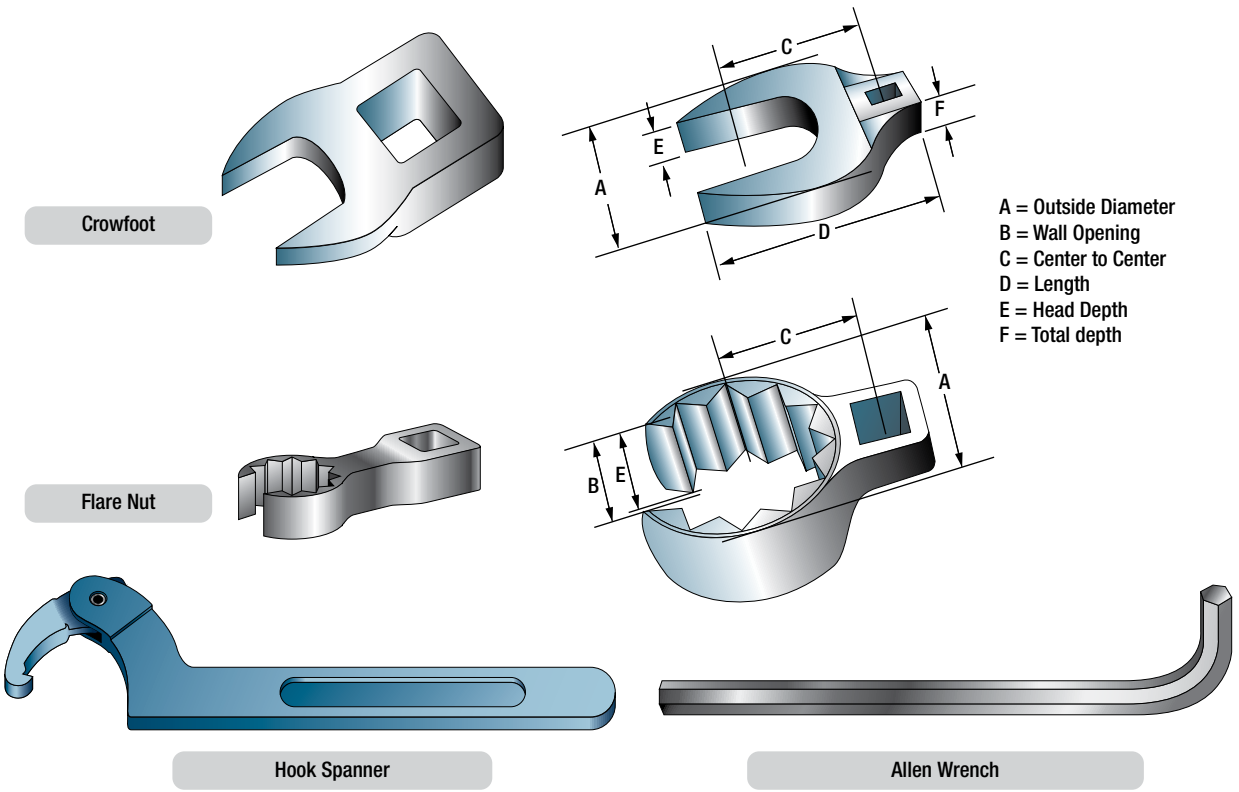

Figure 3-11. Special wrenches.

The hook spanner is for a round nut with a series of notches cut in the outer edge. This wrench has a curved arm with a hook on the end that fits into one of the notches on the nut. The hook is placed in one of these notches with the handle pointing in the direction the nut is to be turned.

Some hook spanner wrenches are adjustable and will fit nuts of various diameters. U-shaped hook spanners have two lugs on the face of the wrench to fit notches cut in the face of the nut or screw plug. End spanners resemble a socket wrench, but have a series of lugs that fit into corresponding notches in a nut or plug. Pin spanners have a pin in place of a lug, and the pin fits into a round hole in the edge of a nut. Face pin spanners are similar to the U-shaped hook spanners except that they have pins instead of lugs.

Most headless setscrews are the hex-head Allen type and must be installed and removed with an Allen wrench. Allen wrenches are six-sided bars in the shape of an L, or they can be hex-shaped bars mounted in adapters for use with hand ratchets. They range in size from 3⁄64 to ½-inch and fit into a hexagonal recess in the setscrew.

STRAP WRENCHES

The strap wrench can prove to be an invaluable tool for the AMT. By their very nature, aircraft components such as tubing, pipes, small fittings, and round or irregularly shaped components are built to be as light as possible, while still retaining enough strength to function properly. The misuse of pliers or other gripping tools can quickly damage these parts. If it is necessary to grip a part to hold it in place, or to rotate it to facilitate removal, consider using a strap wrench that uses a plastic covered fabric strap to grip the part. [**Figure 3-12**]

Figure 5-10, with the front view as principal view. If the right-side view is shown, it will be to the right of the front view. If the left-side view is shown, it will be to the left of the front view. The top and bottom views, if included, will be shown in their respective positions relative to the front view.

One-view drawings are commonly used for objects of uniform thickness, such as gaskets, shims, and plates. A dimensional note gives the thickness as shown in **Figure 5-11**. One-view drawings are also commonly used for cylindrical, spherical, or square parts if all the necessary dimensions can be properly shown in one view. When space is limited and two views must be shown, symmetrical objects are often represented by half views, as illustrated in **Figure 5-12**.

Aircraft drawings seldom show more than two principal or complete views of an object. Instead, there will be usually one complete view and one or more detail views or sectional views.

DETAIL VIEW

A detail view shows only a part of the object, but in greater detail and to a larger scale than the principal view. The part that is shown in detail elsewhere on the drawing is usually encircled by a heavy line on the principal view. [**Figure 5-13**] The principal view shows the complete object, while the detail view is an enlarged drawing of a portion of the object.

PICTORIAL DRAWINGS

A pictorial drawing is like a photograph. [**Figure 5-14**] It shows an object as it appears to the eye, but it is not satisfactory for showing complex forms and shapes. Pictorial drawings are useful in showing the general appearance of an object and are used extensively with orthographic projection drawings. Pictorial drawings are used in Aircraft Maintenance Manuals (AMM), Structural Repair Manuals (SRM), and Illustrated Parts Catalogues (IPC). Three types of pictorial drawings used frequently by aircraft engineers and technicians are: perspective, isometric, oblique, and exploded view.

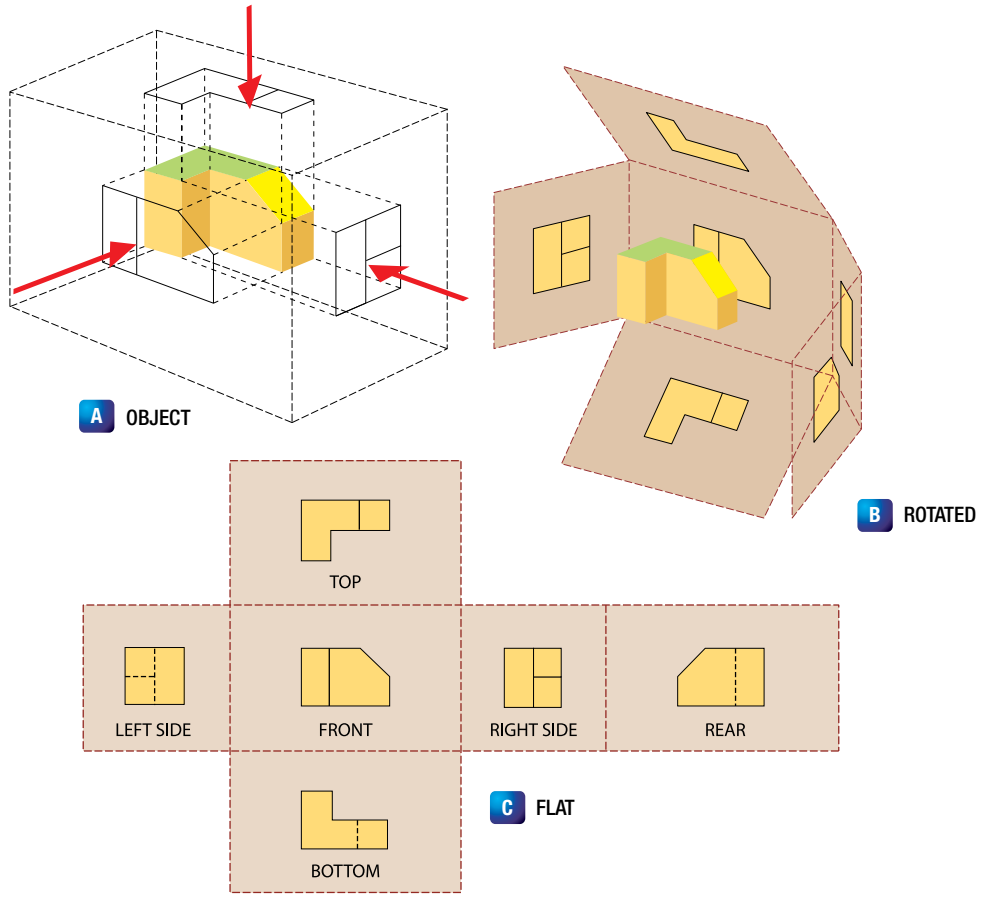

Figure 5-10. Orthographic projection.

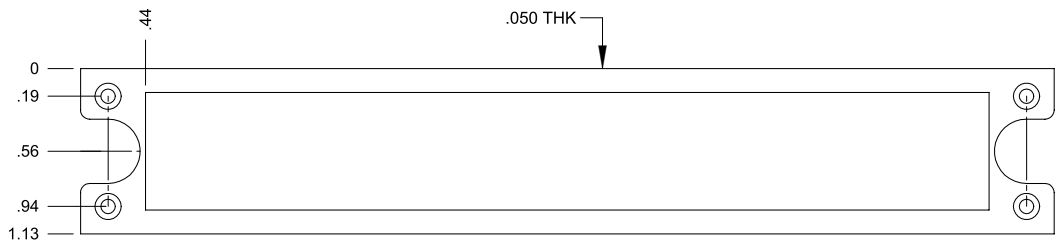

Figure 5-11. One-view drawing.

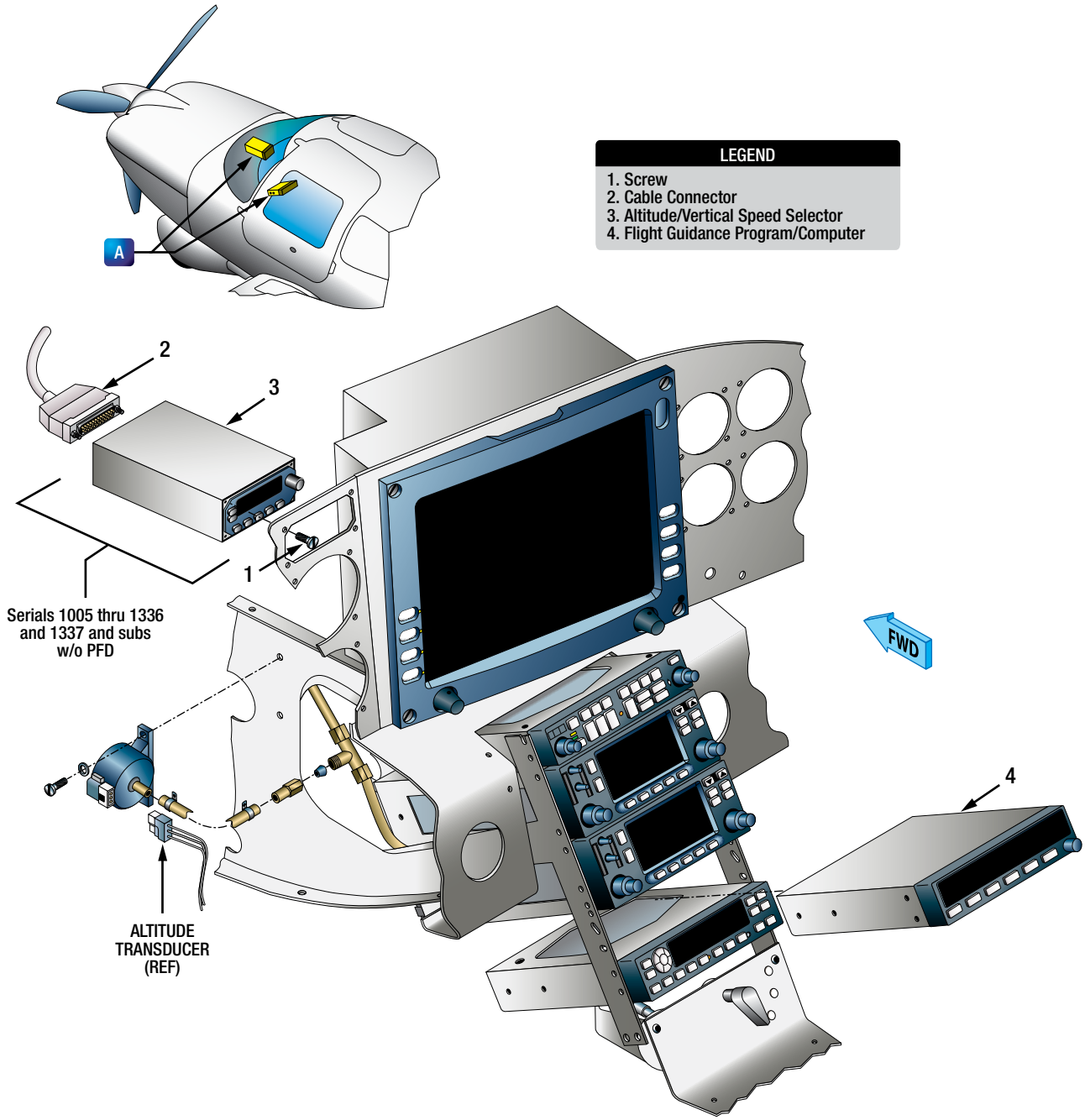

Figure 5-30. Example of an installation diagram (flight guidance components).

GRAPHS AND CHARTS

Graphs and charts are frequently used to convey information graphically or information given certain conditions. They often utilize values shown on the "x" and "y" axes that can be projected up and across to arrive at a specific result. Also, when data is entered into a computer database, software programs can create a variety of different bar graphs, pie charts, and so forth, to graphically represent that data.

READING AND INTERPRETING GRAPHS AND CHARTS

When interpreting information shown on graphs and charts, it is extremely important that all the notes and legend information be carefully understood to eliminate any misinterpretation of the information presented.

NOMOGRAMS

A nomogram is a graph that usually consists of three sets of data. Knowledge of any two sets of data enables the interpreter to obtain the value for the third unknown corresponding value. One type of nomogram consists of three parallel scales graduated for different variables, so that when a straight edge connects any two values, the third can be read directly. Other types may use values on the "x" and "y" axes of a graph with the third corresponding value determined by the intersection of the "x" and "y" values with one of a series of curved lines. **Figure 5-36** is an example of a nomogram that shows the relationship between aviation fuels, specific weight, and temperature.

The aircraft wiring chart shown in **Figure 5-37** depicts a common but more complex type of nomogram. This particular graph is

Density Variation of Aviation Fuel

Based on Average Specific Gravity

Fuel	Average Specific Gravity at 15°C (59°F)
Aviation Kerosene Jet A and Jet A1	0.812
Jet B (JP-4)	0.785
AV Gas Grade 100/130	0.703

NOTE: The fuel quantity indicator is calibrated for correct indication when using Aviation Kerosene Jet A and Jet A1. When using other fuels, multiply the indicated fuel quantity in pounds by 0.99 for Jet B (JP-4) or by 0.98 for Aviation Gasoline (100/130) to obtain actual fuel quantity in pounds.

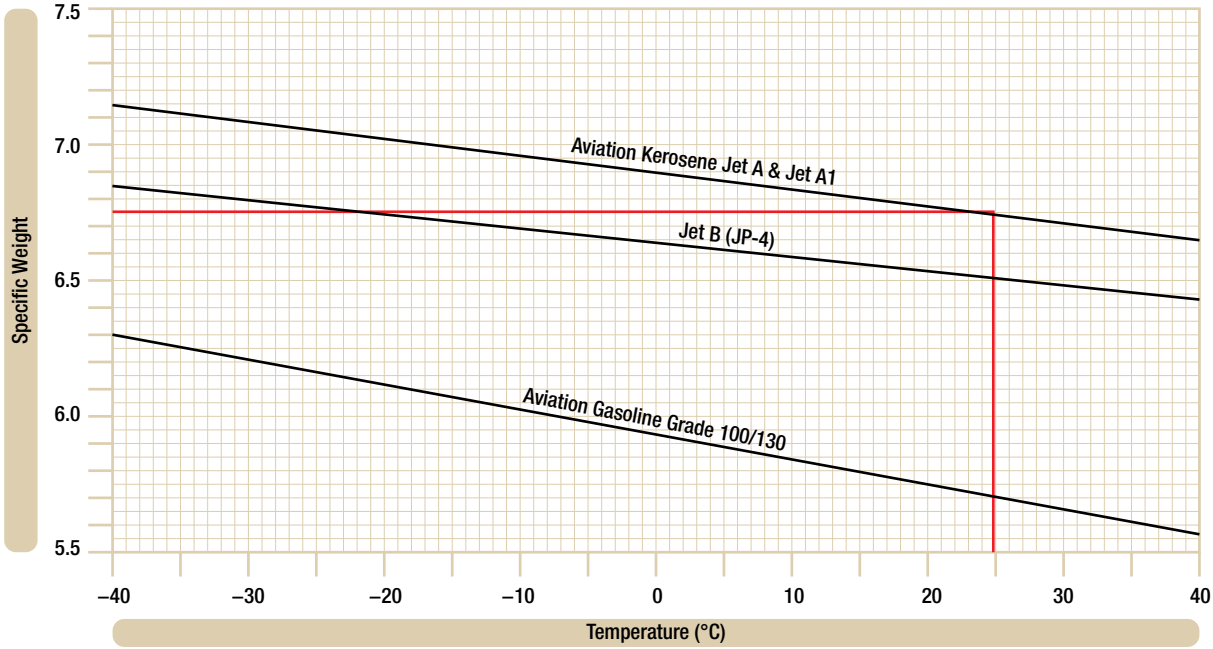

Figure 5-36. Nanogram.

Wire length in feet for allowable voltage drop

Circuit Voltage			
115	200	14	28
800		100	200
600		75	150
400	700	50	100
360	630	45	90
320	560	40	80
280	490	35	70
240	420	30	60
200	350	25	50
160	280	20	40
120	210	15	30
100	175	12	25
80	140	10	20
72	120	9	18
64	112	8	16
56	98	7	14
48	84	6	12
40	70	5	10
36	63	4	9
32	56		8
28	49		7
24	42	3	6
20	35	2	5
4	7	.5	1
Voltage Drop			

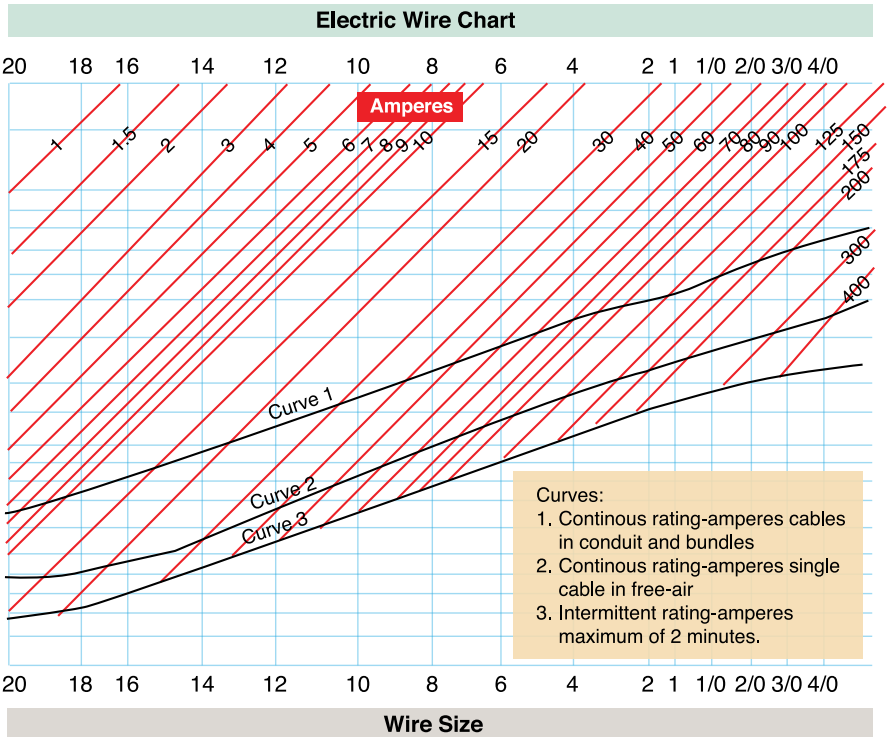

Figure 5-37. Electric wire chart.