MODULE 07A

FOR A CERTIFICATION

MAINTENANCE PRACTICES

Aviation Maintenance Technician Certification Series

COMPLIANT WITH EASA
European Aviation Safety Agency
EASA PART 66/147

AIRCRAFT TECHNICAL BOOK COMPANY

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Tabernash, CO 80478-0270 USA

www.actechbooks.com

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The publishers of this Aviation Maintenance Technician Certification Series welcome you to the world of aviation maintenance. As you move towards EASA certification, you are required to gain suitable knowledge and experience in your chosen area. 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.

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REVISION LOG

VERSION	EFFECTIVE DATE	DESCRIPTION OF CHANGE
001	2020 02	Module Creation and Release

MAINTENANCE PRACTICES

Welcome iii
Revision Log iii
Forward iv
EASA License Category Chart v
General Knowledge Requirements v

SUB-MODULE 01

SAFETY PRECAUTIONS - AIRCRAFT AND WORKSHOP

Knowledge Requirements 1.1
7.1 - Safety Precautions - Aircraft and Workshop 1.2
Safety Around Electricity 1.2
Fire Safety Around Electricity 1.2
Safety Around Compressed Gases 1.2
Oxygen Safety Considerations 1.3
Safety Around Hazardous Materials Such As Oils And Chemicals 1.4
Safety Around Machine Tools 1.5
Fire Safety 1.6
Requirements For A Fire To Occur 1.6
Classification of Fires 1.6
European Standards 1.7
Fire Extinguishers 1.8
Identifying Fire Extinguishers 1.10
Inspection Of Fire Extinguishers 1.11
Using Fire Extinguishers 1.11
Flight Line Safety 1.11
Hearing Protection 1.11
Foreign Object Damage (FOD) 1.11
Safety Around Airplanes 1.12
Safety Around Helicopters 1.12

SUB-MODULE 02

WORKSHOP PRACTICES

Knowledge Requirements 2.1
7.2 - Workshop Practices 2.2
Care and Control of Tools and Materials 2.2
Care Of Tools 2.2
Benches 2.2
Vices 2.2
Drilling Machines 2.2
Grinder 2.2
Motor Drives 2.3
Measuring Instruments 2.3
Drills and Reamers 2.3
Control Of Tools 2.3
Tool Control Procedures 2.3
Workshop Materials 2.4
Dimensions, Allowances, And Tolerances 2.5
Standards of Workmanship 2.5
Tool Calibration 2.6

SUB-MODULE 03

TOOLS

Knowledge Requirements 3.1
7.3 - Tools 3.2
Common Hand Tools 3.2
Screwdrivers 3.2
Pliers And Plier-Type Cutting Tools 3.3
Clamps And Vises 3.4
C-Clamps 3.4
Vises 3.4
Hammers And Mallets 3.4
Punches 3.5
Wrenches 3.6
Open-End Wrenches 3.6
Box-End Wrenches 3.6
Socket Wrenches 3.7
Adjustable Wrenches 3.7
Special Wrenches 3.8
Strap Wrenches 3.8
Impact Wrenches 3.9
Torque Wrenches 3.9
Torque Tables 3.10
Cutting Tools 3.11
Hand Snips 3.12
Metal Shears 3.12
Hacksaws 3.12
Chisels 3.13
Files 3.14
Files and rasps are cataloged in three ways: 3.15
Care Of Files 3.17
Burring Tools 3.17
Reamers 3.17
Taps and Dies 3.18
Hand Power Tools 3.20
Saws 3.20
Circular-Cutting Saws 3.20
Kett Saw 3.20
Pneumatic Circular-Cutting Saw 3.20
Reciprocating Saw 3.20
Die Grinders 3.21
Cut-Off Wheels 3.21

CONTENTS

Nibblers 3.21
Table Top, and Bench Tools 3.22
Notchers 3.22
Band Saws 3.22
Throatless Shears 3.22
Scroll Shears 3.22
Rotary Punch Press 3.23
Foot Operated Shear 3.23
Squaring Shear 3.23
Sanders 3.24
Disk Sander 3.24
Belt Sander 3.24
Grinders 3.24
Grinding Wheels 3.25
Bending And Forming Tools 3.25
Bar Folding Machine 3.26
Cornice Brake 3.26
Box And Pan Brake 3.27
Press Brake 3.27
Slip Roll Former 3.28
Rotary Machine 3.29
Shrinking, Stretching Tools and Procedures 3.29
Shrinking Tools 3.29
Stretching Tools 3.30
Stretch Forming 3.30
Drop Hammer 3.30
Hydropress Forming 3.30
Spin Forming 3.31
Forming With An English Wheel 3.31
Piccolo Former 3.31
Manual Sheet Metal Shrinker 3.32
Hand-Operated Shrinker And Stretcher 3.32
Dollies And Stakes 3.32
Hardwood Form Blocks 3.32
V-Blocks 3.32
Shrinking Blocks 3.33
Sandbags 3.33
Sheet Metal Hammers And Mallets 3.33
Drilling 3.33
Portable Power Drills 3.34
Pneumatic Drill Motors 3.34
Angled Drill Motors 3.34
Two Hole Drill Motors 3.34
Drill Extension And Adapters 3.34
Extension Drill Bits 3.34
Angle Adapters 3.35
Snake Attachment 3.35
Drill Press 3.35
Types of Drill Bits 3.36
Twist Drill Bits 3.36
Step Drill Bits 3.36
Twist Drill Construction and Sizes 3.36
Drill Bit Sizes 3.38
Hole Drilling Techniques 3.38
Drilling Large Holes 3.39
Drill Lubrication 3.42
Drill Accessories 3.42
Drill Stops 3.42
Drill Bushings 3.42
Drill Bushing Holder 3.42
Presicion Measuring Tools 3.43
Rules 3.43
Combination Sets 3.43
Scriber 3.44
Dividers And Pencil Compasses 3.44
Calipers 3.45
Micrometer Calipers 3.45
Micrometer Parts 3.46
Reading A Micrometer 3.46
Vernier Scale 3.47
Using A Micrometer 3.48
Dial Indicator 3.48
Slide Calipers 3.48
Lubrication Equipment 3.48
Electrical Test Equipment 3.50
DC Measuring Equipment 3.50
D'arsonval Meter Movement 3.50
Dampening 3.51
Basic Multirange Ammeter 3.51
Precautions 3.52
The Voltmeter 3.52
Voltmeter Sensitivity 3.53
MultiRange Voltmeters 3.53
Voltmeter Circuit Connections 3.53
Influence of the Voltmeter in the Circuit 3.53
The Ohmmeter 3.53
Zero Adjustment 3.53
Ohmmeter Scale 3.53
Multirange Ohmmeter 3.55
Megger (Megohmmeter) 3.55
AC Measuring Equipment 3.56
Electrodynamometer Meter Movement 3.57
Moving Iron Vane Meter 3.57
Inclined Coil Iron Vane Meter 3.58

Varmeters 3.58
Wattmeter 3.58
Frequency Measuring Oscilloscope 3.59
Horizontal Deflection 3.60
Vertical Deflection 3.61
Tracing a Sine Wave 3.61
Control Features on an Oscilloscope 3.61
Flat Panel Color Displays for Oscilloscopes .. 3.62
Digital Multimeter 3.62
Basic Circuit Analysis And Troubleshooting 3.63
Voltage Measurement 3.63
Current Measurement 3.64
Checking Resistance In A Circuit 3.64
Continuity Checks 3.65
Capacitance Measurement 3.65
Inductance Measurement 3.66
Troubleshooting The Open Faults In Series Circuits 3.66
Troubleshooting The Shorting Faults In Series Circuits 3.67
Troubleshooting The Open Faults In Parallel Circuits 3.68
Troubleshooting The Shorting Faults In Parallel Circuits 3.69
Troubleshooting The Shorting Faults In Series-Parallel Circuits 3.70
Tracing Opens With The Voltmeter 3.70

SUB-MODULE 04
AVIONIC GENERAL TEXT EQUIPMENT
Knowledge Requirements 4.1

SUB-MODULE 05
ENGINEERING DRAWINGS, DIAGRAMS AND STANDARDS
Knowledge Requirements 5.1
7.5 - Engineering Drawings, Diagrams, and Standards 5.2
Purpose and Function of Aircraft Drawings 5.2
Care and Use of Drawings 5.2
Drawing and Diagram Types: Symbols, Dimensions, Tolerances and Projections 5.2
Drawing Types 5.2
Detail Drawings 5.2
Assembly Drawings 5.2
Installation Drawings 5.5
Sectional View Drawings 5.5
Bill of Material 5.5
Other Drawing Data 5.5
Revision Block 5.5
Zone Numbers 5.5
Station Numbers and Location Identification On Aircraft 5.5
Allowances and Tolerances 5.7
Finish Marks 5.8
Scale 5.8
Methods of Illustration 5.8
Orthographic Projection 5.8
Pictorial Drawings 5.10
Lines and Their Meanings 5.12
Centerlines 5.13
Dimension Lines 5.13
Extension Lines 5.13
Sectioning Lines 5.14
Phantom Lines 5.14
Break Lines 5.14
Leader Lines 5.14
Hidden Lines 5.14
Outline or Visible Lines 5.14
Stitch Lines 5.14
Cutting Plane and Viewing Plane Lines 5.14
Drawing Symbols 5.14
Material Symbols 5.14
Shape Symbols 5.15
Electrical Symbols 5.15
Care of Drafting Instruments 5.15
Title Blocks 5.15
Drawing or Print Numbers 5.15
Reference and Dash Numbers 5.17
Computer Graphics 5.17
Digital Images 5.18
Spec 100 of the Air Transport Association (ATA) .. 5.18
ATA 100 and iSpec 2200 ..... 5.18
Aeronautical Standards 5.19
ISO 5.20
AN (Army/Navy) 5.20
MS (Military Standard) 5.20
NAS (National Aerospace Standard) 5.20
BS (British Standards) 5.20
Wiring and Schematic Diagrams 5.20
Diagrams 5.20
Installation Diagrams 5.20
Schematic Diagrams 5.20
Block Diagrams 5.21
Wiring Diagrams (Schematics) 5.21

Flowcharts 5.23
Troubleshooting Flowchart 5.23
Logic Flowchart 5.23

SUB-MODULE 06
FITS AND CLEARANCES

Knowledge Requirements 6.1
7.6 - Fits and Clearances 6.2
Drill Sizes for Holes 6.2
Accuracy of Drilled Holes 6.2
Classes of Fit 6.2
Standards of Fits and Clearances 6.2
British Standards BS 4500 System 6.3
BS 4500 Definitions: 6.3
BS 4500 Basic Hole System 6.3
BS 4500 Basic Shaft System 6.4
Basic Hole Method - Metric 6.4
Dimensions, Allowances and Tolerances 6.4
Dimensions 6.5
Allowances 6.5
Tolerances 6.5
Schedule of Fits and Clearances 6.5
Limts for Bow, Twist and Wear 6.6
Limits for Bow 6.6
Limits for Twist 6.6
Limits for Wear 6.6
Limits for Ovality 6.6
Methods for Checking Shafts, Bearings and Other Parts 6.6
Checking for Bow 6.6
Clearance Measured By Feeler Gauges 6.7
Checking for Twist 6.7
Piston Engine Connecting Rod Twist 6.7
Checking for Ovality 6.7

SUB-MODULE 07
ELECTRICAL WIRING INTERCONNECTION SYSTEM (EWIS)

Knowledge Requirements 7.1
7.7 - Electrical Wiring Interconnect System (EWIS) 7.2
Continuity, Insulation, Bonding, and Testing 7.2
Continuity 7.2
Insulation 7.2
Bonding and Grounding 7.3
Grounding 7.3
Bonding 7.4
Crimping Tools; Hand and Hydraulic 7.4
Crimping Tools 7.5
Inspection and Testing of Crimped Joints 7.5
Connector Pin Removal and Insertion 7.5
Insertion 7.6
Removal 7.6
Adjacent Locations 7.6
Sealing 7.6
Drainage 7.8
Coaxial Cable 7.8
Testing Coaxial Cable 7.8
Identification of Wire Types, Inspection and Damage Tolerance 7.8
Identification of Wire Types 7.8
Placement of Identification Markings 7.9
Types of Wire Markings 7.10
Wire Inspection 7.10
Wire Protection: Cable Looms and Support, Clamps, Heat Shrink Wrap and Shielding 7.10
Wire Bundles and Routing 7.11
Slack in Wire Bundles 7.11
Twisting Wires 7.11
Spliced Connections In Wire Bundles 7.12
Lacing and Tying Wire Bundles 7.12
Bend Radii 7.13
Wire Protection 7.14
Protection Against Chafing 7.14
Protection Against High Temperature 7.14
Protection Against Solvents and Fluids 7.14
Protection of Wires in Wheel Well Areas 7.15
Clamp Installation 7.15
Wire and Cable Clamp Inspection 7.16
Movable Controls Wiring Precautions 7.18
Conduit 7.18
Heat Shrink Wrapping 7.18
Wire Shielding 7.18
EWIS Installation, Repair, Maintenance and Cleanliness 7.19
EWIS Standards 7.19
EWIS Inspection, Repair and Maintenance 7.19
EWIS Cleaning Requirements and Methods 7.21

SUB-MODULE 08
RIVETING

Knowledge Requirements 8.1
7.8 - Rivets 8.2
Riveted Joints, Rivet Spacing and Pitch 8.2

Solid Shank Rivet 8.2
Description 8.2
Rivet Head Shape 8.2
Installation of Rivets 8.3
Repair Layout 8.3
Rivet Length 8.4
Rivet Spacing 8.4
Edge Distance 8.4
Rivet Pitch 8.5
Transverse Pitch 8.5
Rivet Installation Tools 8.5
Hand Tools 8.5
Rivet Cutter 8.5
Bucking Bar 8.5
Hand Rivet Set 8.6
Dimpling Dies 8.6
Chip Chasers 8.6
Riveting Power Tools 8.6
Pneumatic Rivet Gun 8.6
Rivet Sets/Headers 8.8
Microshavers 8.8
Compression Riveting 8.8
Reusable Sheet Metal Fasteners 8.8
Cleco Fasteners 8.9
Hex Nut and Wing Nut Temporary Fasteners 8.9
Riveting Procedures 8.9
Hole Transfer 8.9
Hole Preparation 8.9
Drilling 8.10
Driving The Rivet 8.10
Countersunk Rivets 8.10
Countersink Tools 8.11
Dimpling 8.12
Inspection of Riveted Joints 8.13
Removal of Rivets 8.13
Replacing Rivets 8.14

SUB-MODULE 09
PIPES AND HOSES

Knowledge Requirements 9.1
7.9 - Pipes and Hoses 9.2
Tubing Sizes 9.2
Fabrication, Bending and Flaring of Metal Tube Lines 9.2
Tube Cutting 9.2
Tube Bending 9.3
Tube Flaring 9.4
Rolling-Type Flaring Tools 9.5
Double Flaring 9.5
Beading 9.5
Inspection and Testing of Pipes and Hoses 9.6
Rigid Tubing Inspection and Inspection 9.6
Flexible Hose Inspection 9.6
Flexible hose Size Designations 9.7
Fabrication and Replacement of Flexible Hose 9.7
Flexible Hose Testing 9.7
Installation and Clamping of Pipes 9.7
Rigid Tube Installation and Inspection 9.7
Connection and Torque 9.8
Flareless Tube Installation 9.9
Installation of Flexible Hose Assemblies 9.9
Hose Clamps 9.10

SUB-MODULE 10
SPRINGS

Knowledge Requirements 10.1
7.10 - Springs 10.2
Inspection and Testing of Springs 10.2
Corrosion 10.2
Overheating 10.2
Fatigue 10.2
Static Measurment 10.2
Load Deflection 10.2

SUB-MODULE 11
BEARINGS

Knowledge Requirements 11.1
7.11 - Bearings 11.2
Testing, Cleaning, and Inspection of Bearings 11.2
Testing Bearings 11.2
Cleaning the Wheel Bearings 11.2
Wheel Bearing Inspection 11.2
Lubricaton Requirement of Bearing 11.4
Bearing Handling and Lubrication 11.4
Lubricants 11.4
Storage 11.5
Defects in BEarings and Their Causes 11.5
Contamination and Corrosion 11.5
Electric Current Damage 11.5

SUB-MODULE 12
TRANSMISSIONS

Knowledge Requirements 12.1
7.12 - Transmissions 12.2
Inspection of Gears, Backlash 12.2

Gears 12.2
Lash and Pattern 12.2
Inspection of Belts and Pulleys, Chains and Sprockets 12.3
Belts and Pulleys 12.3
Chains and Sprockets 12.3
Inspection of Jackscrews, Lever Devices, Push-pull Rod Systems 12.4
Jack Screws 12.4
Levers 12.4
Push-pull Rod Systems 12.4

SUB-MODULE 13
CONTROL CABLES
Knowledge Requirements 13.1
7.13 - Control Cables 13.2
Swaging of End Fittings 13.2
Terminals 13.2
Splicing 13.2
Swaged Ball Terminals 13.3
Cable Slippage In Terminal 13.3
Nicopress® Swaged End Fittings 13.3
Inspection and Testing of Cables 13.4
Manufacturer Wire Splices 13.6
Testing Cable Tension 13.7
Aircraft Flexible Control Systems 13.7
Bowden Cable Systems 13.7
Teleflex Cable Systems 13.8
Attachment Of Teleflex End Fittings 13.8

SUB-MODULE 14
MATERIAL HANDLING
Knowledge Requirements 14.1

SUB-MODULE 15
WELDING, BRAZING, SOLDERING AND BONDING
Knowledge Requirements 15.1

SUB-MODULE 16
AIRCRAFT WEIGHT AND BALANCE
Knowledge Requirements 16.1

SUB-MODULE 17
AIRCRAFT HANDLING AND STORAGE
Knowledge Requirements 17.1
7.17 - Aircraft Handling and Storage 17.2
Aircraft Taxiing And Towing 17.2
Engine Starting and Operation 17.2
Reciprocating Engines 17.2
Hand Cranking Engines 17.3
Turboprop Engines 17.4
Turbofan Engines 17.6
Auxiliary Power Units (APUs) 17.8
Unsatisfactory Turbine Engine Starts 17.8
Extinguishing Engine Fires 17.8
Taxiing Aircraft 17.9
Taxi Signals 17.9
Towing Aircraft 17.11
Aircraft Jacking, Chocking And Securing 17.13
Aircraft Jacking 17.13
Tiedown, Chocking and Securing 17.14
Securing Light Aircraft 17.14
Securing Heavy Aircraft 17.15
Tiedown Procedures For Seaplanes 17.16
Tiedown Procedures For Skiplanes 17.16
Tiedown Procedures For Helicopters 17.16
Aircraft Storage Methods 17.17
Hangars 17.17
Fire Precautions 17.17
Storage Processes 17.18
Phase 1 – Preparation 17.18
Phase 2 – Routine Servicing 17.18
Phase 3 – Repreparation In Storage 17.18
Phase 4 – Return To Service 17.18
Fuel Servicing Of Aircraft 17.18
Fuel Types And Identification 17.18
Contamination Control 17.19
Fueling Hazards 17.19
Grounding And Bonding 17.19
Fueling Procedures 17.20
Over The Wing Refueling 17.20
Pressure Refueling 17.20
Defueling 17.21
Ground De-icing and Anti-Icing of Aircraft 17.22
De-icing And Anti-icing of Transport Aircraft 17.22
Deicing Fluid 17.22
Holdover Time (HOT) 17.22
Critical Surfaces 17.22
Frost Removal 17.24
Ice And Snow Removal 17.24
Ground Power Supplies; Electric, Hydraulic And Pneumatic 17.24
Electric Ground Power Units 17.24
Hydraulic Ground Power Units 17.25

Ground Support Air Units 17.26
Ground Air Heating and Air Conditioning 17.26
Oxygen Servicing Equipment 17.26
Oxygen Hazards 17.26
Air/Nitrogen, Oil, And Fluid Servicing 17.26
Effect of Environmental Conditions On Aircraft Handling and Operation 17.27

SUB-MODULE 18

DISASSEMBLY, INSPECTION, REPAIR AND ASSEMBLY TECHNIQUES

Knowledge Requirements 18.1
7.18 - Disassembly, Inspection, Repair And Assembly Techniques 18.2
Types Of Defects And Visual Inspection; Corrosion Removal, Assesment, and Reprotection 18.2
Basic Inspection Techniques And Practices 18.2
Preparation 18.2
Aircraft Logs 18.3
Checklists 18.3
Publications 18.4
Manufacturers' Service Bulletins/Instructions 18.4
Maintenance Manuals 18.5
Visual Inspection Techniques 18.5
Types of Defects 18.5
External Damage 18.6
Inlets And Exhausts 18.6
Liquid Systems 18.6
Gaseous Systems 18.6
Landing Gear 18.7
System Indicators And Gauges 18.7
Probes 18.7
Handles, Latches, Panels And Doors 18.7
Other Inspection Items 18.8
Life Limited Items 18.8
Corrosion Removal, Assessment And Reprotection 18.8
Preventive Maintenance 18.8
Corrosion Removal 18.9
Surface Cleaning And Paint Removal 18.9
Corrosion Of Ferrous Metals 18.10
Mechanical Removal Of Iron Rust 18.10
Chemical Removal Of Rust 18.10
Removal Of Corrosion From Highly Stressed Steel Parts 18.11
Corrosion Of Aluminum And Aluminum Alloys 18.11
Treatment of Unpainted Aluminum Surfaces 18.11
Treatment Of Anodized Surfaces 18.12
Corrosion Of Magnesium Alloys 18.12
Treatment Of Wrought Magnesium Sheet And Forgings 18.12
Treatment Of Installed Magnesium Castings 18.13
Corrosion Of Titanium And Titanium Alloys .. 18.13
Protection Of Dissimilar Metal Contacts 18.13
Contacts Not Involving Magnesium 18.13
Contacts Involving Magnesium 18.13
Corrosion Limits 18.14
Surface Preparation 18.14
Chemical Treatments 18.14
Anodizing 18.14
Alodizing 18.15
Chemical Surface Treatment and Inhibitors .. 18.15
Disassembly and Re-Assembly Techniques 18.15
Replacement Of Major Components And Modules 18.16
Disassembly And Re-assembly Of Major Components 18.16
Disassembly And Re-assembly Of Minor Components 18.17
Basic Disassembly and Re-assembly Techniques 18.17
Discarding of Parts 18.18
Freeing Seized Components 18.18
Assembly 18.18

SUB-MODULE 19

ABNORMAL EVENTS

Knowledge Requirements 19.1
7.19 - Abnormal Events 19.2
Special Inspections 19.2
Electrical Related Damage 19.2
Lightning Strikes 19.2
High Intensity Radiated Fields (HIRF) Penetration 19.3
Specific Testing - HIRF 19.4
Structural Related Damage 19.4
Hard or Overweight Landings 19.4
Post Heavy Landing Inspection 19.4
Severe Turbulence Inspection 19.5
Other Types of Damage 19.5
Fire Damage 19.5
Flood Damage 19.6
Seaplanes 19.6
Aerial Application Aircraft 19.6

SUB-MODULE 20

MAINTENANCE PROCEDURES

Knowledge Requirements 20.1

CONTENTS

7.20 - Maintenance Procedures 20.2
Maintenance Planning 20.2
Modification Procedures 20.2
Stores Procedures 20.3
Certification And Release Procedures 20.4
Interface with Aircraft Operation 20.4
Maintenance Inspection; Quality Control
And Assurance 20.5
Additional Maintenance Procedures 20.5
Control of Life Limited Components 20.6

Acronym Index A.1

7.3 - TOOLS

The aviation maintenance technician spends a major portion of each day using a wide variety of hand tools to accomplish maintenance tasks. This chapter contains an overview of some of the hand tools the aircraft maintenance professional can expect to use. A technician encounters many special tools as their experience widens; large transport category aircraft have different maintenance tasks from those of a light airplane, and special hand tools are often required when working on complex aircraft.

This chapter outlines the basic knowledge required in using the most common hand tools and measuring instruments used in aircraft repair work. This information, however, cannot replace sound judgment on the part of the individual, nor additional training as the need arises. There are many times when ingenuity and resourcefulness can supplement the basic rules. Sound knowledge is required of these basic rules and of the situations in which they apply. The use of tools may vary, but good practices for safety, care, and storage of tools remain the same.

COMMON HAND TOOLS

SCREWDRIVERS

The screwdriver can be classified by its shape, type of blade, and blade length. It is made for only one purpose, i.e., for loosening or tightening screws or screw head bolts. ***Figure 3-1*** shows several different types of screwdrivers. When using the common screwdriver, select the largest screwdriver whose blade will make a good fit in the screw that is to be turned.

A common screwdriver must fill at least 75 percent of the screw slot. If the screwdriver is the wrong size, it cuts and burrs the screw slot, making it worthless. The damage may be so severe that the use of screw extractor may be required. A screwdriver with the wrong size blade may slip and damage adjacent parts of the structure. The common screwdriver is used only where slotted head screws or fasteners are found on aircraft. An example of a fastener that requires the use of a common screwdriver is the cam-lock style fastener that is used to secure the cowling on some aircraft.

The two types of recessed head screws in common use are the Phillips and the Reed & Prince. Both the Phillips and Reed & Prince recessed heads are optional on several types of screws. As shown in ***Figure 3-1***, the Reed & Prince recessed head forms a perfect cross. The screwdriver used with this screw is pointed on the end. Since the Phillips screw has a slightly larger center in the cross, the Phillips screwdriver is blunt on the end. The Phillips screwdriver is not interchangeable with the Reed & Prince. The use of the wrong type screwdriver results in mutilation of the screwdriver and the screw head. When turning a recessed head screw, use only the proper recessed head screwdriver of the correct size. The most common crosspoint screwdrivers are the No. 1 and No. 2 Phillips.

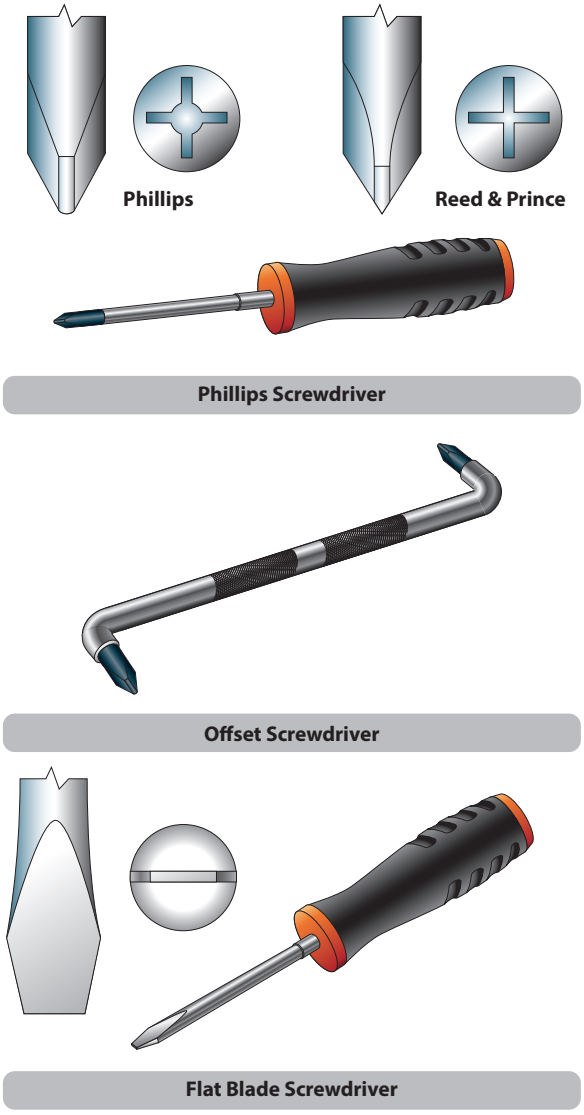

Figure 3-1. Typical screwdrivers.

An offset screwdriver may be used when vertical space is limited. Offset screwdrivers are constructed with both ends bent 90° to the shank handle. By using alternate ends, most screws can be seated or loosened even when the swinging space is limited. Offset screwdrivers are made for both standard and recessed head screws. Ratcheting right angle screwdrivers are also available, and often prove to be indispensable when working in close quarters.

A screwdriver should not be used for chiseling or prying. Do not use a screwdriver to check an electric circuit since an electric arc will burn the tip and make it useless. In some cases, an electric arc may fuse the blade to the unit being checked, creating a short circuit.

When using a screwdriver on a small part, always hold the part in the vise or rest it on a workbench. Do not hold the part in the hand, as the screwdriver may slip and cause serious personal injury.

Replaceable tip screwdrivers, sometimes referred to as "10 in 1" screwdrivers, allow for the quick changing of a screwdriver tip, and economical replacement of the tip when it becomes worn. A wide variety of screwdriver tips, including flat, crosspoint (Phillips and Reed & Prince), Torx and square drive tips are available for use with the handles. (***Figure 3-2***)

The cordless hand-held power screwdriver has replaced most automatic or spiral screwdrivers for the removal of multiple screws from an airframe. Care must be exercised when using a power screwdriver; if the slip clutch is set for too high a setting when installing a screw, the screwdriver tip will slip and rotate on top of the screw head, damaging it. The screw should be started by hand, to avoid driving the screw into the nut or nut plate in a cross-threaded manner. To avoid damaging the slot or receptacle in the head of the screw, the use of cordless power drills fitted with a removable tip driver to remove or install screws is not recommended, as the drill does not have a slip-clutch installed.

PLIERS AND PLIER-TYPE CUTTING TOOLS

As shown in ***Figure 3-3***, the pliers used most frequently in aircraft repair work are the diagonal, needlenose, and duckbill. The size of pliers indicates their overall length, usually ranging from 5 to 12 inches.

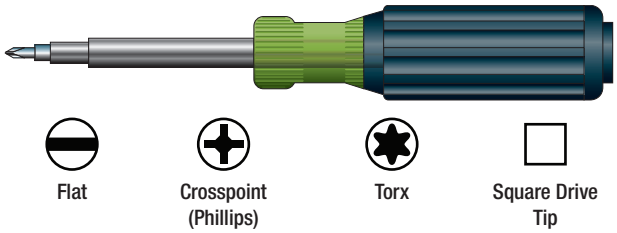

Figure 3-2. Replaceable tip screwdriver.

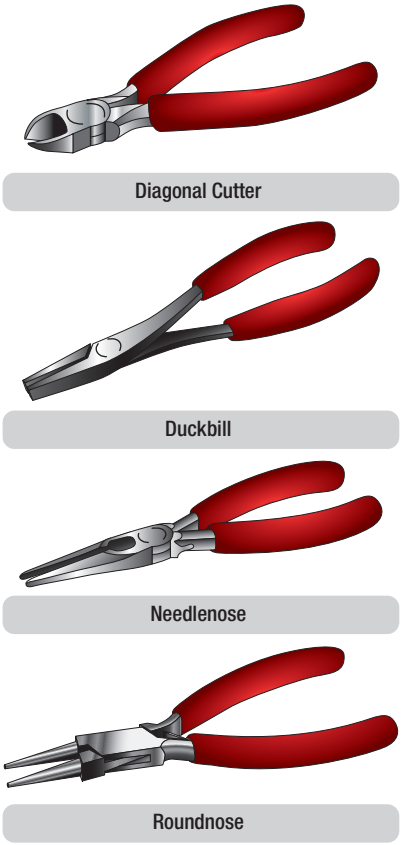

Figure 3-3. Pliers.

Roundnose pliers are used to crimp metal. They are not made for heavy work because too much pressure will spring the jaws, which are often wrapped to prevent scarring the metal.

Needlenose pliers have half round jaws of varying lengths. They are used to hold objects and make adjustments in tight places.

Duckbill pliers resemble a "duck's bill" in that the jaws are thin, flat, and shaped like a duck's bill. They are used exclusively for twisting safety wire.

Diagonal pliers are usually referred to as diagonals or "dikes." The diagonal is a short-jawed cutter with a blade set at a slight angle on each jaw. This tool can be used

to cut wire, rivets, small screws, and cotter pins, besides being practically indispensable in removing or installing safety wire. The duckbill pliers and the diagonal cutting pliers are used extensively in aviation for the job of safety wiring.

Two important rules for using pliers are:

1. Do not make pliers work beyond their capacity. The long-nosed variety is especially delicate. It is easy to spring or break them, or nick the edges. If this occurs, they are practically useless.
2. Do not use pliers to turn nuts. In just a few seconds, a pair of pliers can damage a nut more than years of service.

CLAMPS AND VISES

In order to work with sheet metal during the fabrication process, the aviation technician uses a variety of holding devices, such as clamps, vises, and fasteners (see *Sub-Module 08* for more on fasteners) to hold the work together. The type of operation being performed and the type of metal being used determine what type of the holding device is needed.

Clamps and vises hold materials in place when it is not possible to handle a tool and the workpiece at the same time. A clamp is a fastening device with movable jaws that has opposing, often adjustable, sides or parts. An essential fastening device, it holds objects tightly together to prevent movement or separation.

Clamps can be either temporary or permanent. A clamp is a fastening device with movable jaws that has opposing, often adjustable, sides or parts. An essential fastening device, it holds objects tightly together to prevent movement or separation. Temporary clamps, such as the carriage clamp (commonly called the C-clamp), are used to position components while fixing them together.

C-Clamps

The C-clamp is shaped like a large C and has three main parts: threaded screw, jaw, and swivel head. (***Figure 3-4***) The swivel plate or flat end of the screw prevents the end from turning directly against the material being clamped. C-clamp size is measured by the dimension of the largest object the frame can accommodate with the screw fully extended. The distance from the center line of the screw to the inside edge of the frame or the depth of throat is also an important consideration when using this clamp. C-clamps vary in size from one inch upward. C-clamps can leave marks on aluminum, protect the aircraft covering with masking tape at the places where the C-clamp is used.

Vises

Vises are another clamping device that hold the workpiece in place and allow work to be done on it with tools such as saws and drills.

The vise consists of two fixed or adjustable jaws that are opened or closed by a screw or a lever. The size of a vise is measured by both the jaw width and the capacity of the vise when the jaws are fully open. Vises also depend on a screw to apply pressure, and their textured jaws enhance gripping ability beyond that of a clamp.

Two of the most commonly used vises are the machinist's vise and the utility vise. The machinist's vise has flat jaws and usually a swivel base, whereas the utility bench vise has scored, removable jaws and an anvil-faced back jaw. This vise holds heavier material than the machinist's vise and also grips pipe or rod firmly. The back jaw can be used as an anvil if the work being done is light. To avoid marring metal in the vise jaws, add some type of padding, such as a ready-made rubber jaw pad.
(***Figure 3-5***)

HAMMERS AND MALLETS

Figure 3-6 shows some of the hammers that the aviation mechanic may be required to use. Metal head hammers are usually sized according to the weight of the head without the handle.

Occasionally it is necessary to use a soft-faced hammer, which has a striking surface made of wood, brass, lead, rawhide, hard rubber, or plastic. These hammers are intended for use in forming soft metals and striking surfaces that are easily damaged. Soft-faced hammers should not be used for striking punch heads, bolts, or nails, as using one in this fashion will quickly ruin this type of hammer. A mallet is a hammer-like tool with a head made of hickory, rawhide, or rubber. It is handy for shaping thin metal parts without causing creases or dents with abrupt corners. Always use a wooden mallet when pounding a wood chisel or a gouge.

Figure 3-4. C-clamps.

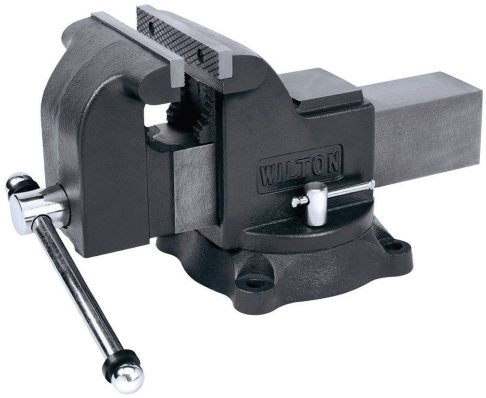

Figure 3-5. Utility vise with swivel base and anvil.

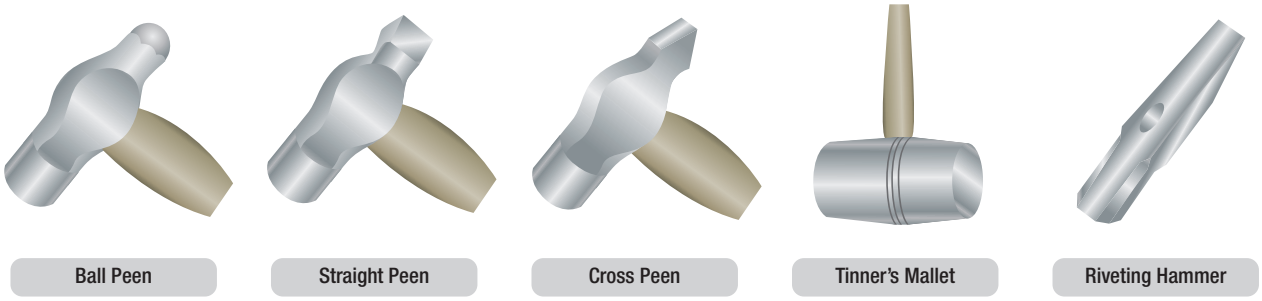

Figure 3-6. Hammers.

When using a hammer or mallet, choose the one best suited for the job. Ensure that the handle is tight. When striking a blow with the hammer, use the forearm as an extension of the handle. Swing the hammer by bending the elbow, not the wrist. Always strike the work squarely with the full face of the hammer. When striking a metal tool with a metal hammer, the use of safety glasses or goggles is strongly encouraged. Always keep the faces of hammers and mallets smooth and free from dents, chips, or gouges to prevent marring the work.

PUNCHES

Punches are used to locate centers for drawing circles, to start holes for drilling, to punch holes in sheet metal, to transfer location of holes in patterns, and to remove damaged rivets, pins or bolts. Solid or hollow punches are the two types generally used. Solid punches are classified according to the shape of their points. ***Figure 3-7*** shows several types of punches.

Prick punches are used to place reference marks on metal. This punch is often used to transfer dimensions from a paper pattern directly on the metal. To do this, first place the paper pattern directly on the metal. Then go over the outline of the pattern with the prick punch, tapping it lightly with a small hammer and making slight indentations on the metal at the major points on the drawing. These indentations can then be used as reference marks for cutting the metal. A prick punch should never be struck a heavy blow with a hammer because it may bend the punch or cause excessive damage to the material being worked.

Large indentations in metal, which are necessary to start a twist drill, are made with a center punch. It should never be struck with enough force to dimple the material around the indentation or to cause the metal to protrude through the other side of the sheet. A center punch has a heavier body than a prick punch and is ground to a point with an angle of about 60°.

The drive punch, which is often called a tapered punch, is used for driving out damaged rivets, pins, and bolts that sometimes bind in holes. The drive punch is therefore made with a flat face instead of a point. The size of the punch is determined by the width of the face, which is usually 1/8 inch to 1/4 inch. Pin punches, often called drift punches, are similar to drive punches and are used for the same purposes. The difference between the two is that the sides of a drive punch taper all the way to the face while the pin punch has a straight shank. Pin punches are sized by the diameter of the face, in

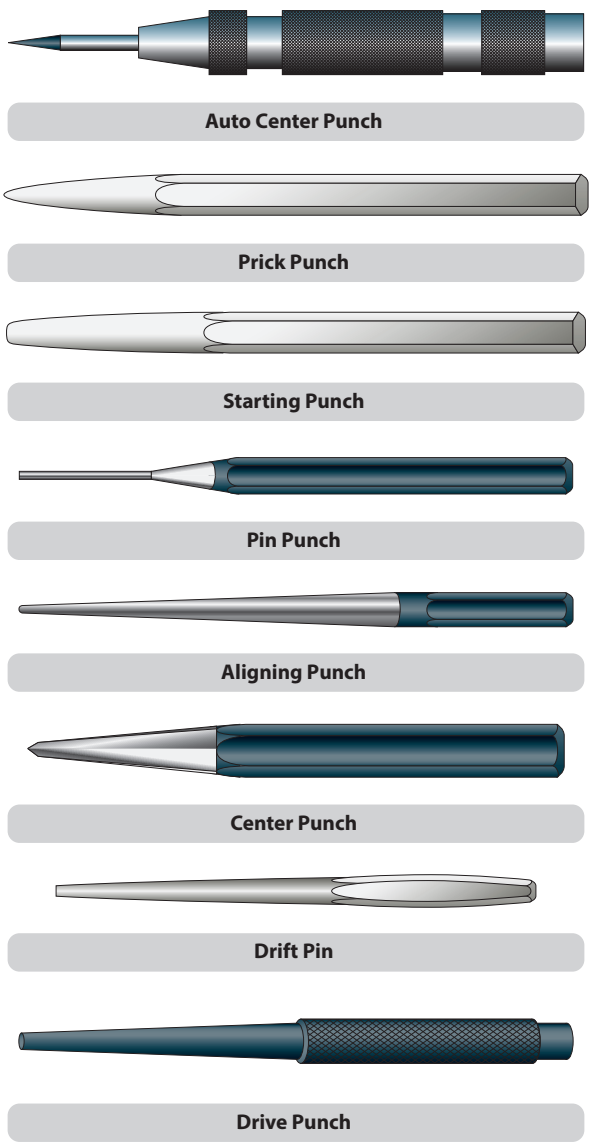

Figure 3-7. Punches.

thirty-seconds of an inch, and range from 1/16 to 3/8 inch in diameter. In general practice, a pin or bolt which is to be driven out is usually started and driven with a drive punch until the sides of the punch touch the side of the hole. A pin punch is then used to drive the pin or bolt the rest of the way out of the hole. Stubborn pins may be started by placing a thin piece of scrap copper, brass, or aluminum directly against the pin and then striking it with a hammer until the pin begins to move.

Never use a prick punch or center punch to remove objects from holes because the point of the punch will spread the object and cause it to bind even more.

The transfer punch is usually about 10 cm long. It has a point that tapers, and then turns straight for a short distance in order to fit a drill locating hole in a template. The tip has a point similar to that of a prick punch. As its name implies, the transfer punch is used to transfer the location of holes through the template or pattern to the material.

WRENCHES

The wrenches most often used in aircraft maintenance are classified as open-end, box-end, socket, adjustable, ratcheting and special wrenches. The Allen wrench, is required on one special type of recessed screw. One of the most widely used metals for making wrenches is chrome-vanadium steel. Wrenches made of this metal are almost unbreakable.

Open-End Wrenches

Solid, nonadjustable wrenches with open parallel jaws on one or on both ends are known as open-end wrenches. Open-end wrenches may have their jaws parallel to the handle or at an angle of up to 90°; most are set at an angle of 15°. The wrenches are designed to fit on a nut, bolt head, or other object, which makes it possible to exert a turning action.

Box-End Wrenches

Box-end wrenches are popular tools because of their usefulness in close quarters. They are called box wrenches since they box, or completely surround, the nut or bolt head. Practically all well-manufactured box-end wrenches are made with 12 points so they can be used in places having as little as 15° swing. In ***Figure 3-8***, point

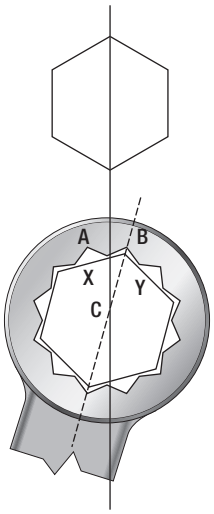

Figure 3-8. Box-end wrench use.