International AME Practical Skill

(Adapted from ICAO AME Training Standards.)

For over two decades, aviation maintenance employers outside the major airlines have identified the failure of competency based training to provide practical skills needed by the industry. This training deficiency came about when the Authority stopped promulgating national training syllabi for aircraft maintenance engineers based on ICAO international training standards. Instead of industry wide transportable skills, local RTOs geared their training to meet the needs of the largest employers and not the wider industry. The following are the international standards for practical skills that should be completed before the students begin working on airworthy aircraft, engines or equipment.

Chapter 10 – PRACTICAL MAINTENANCE SKILLS: AIRFRAME

INTRODUCTION

In order to be able to satisfactorily assimilate the training on individual aircraft and systems, the Aircraft Maintenance (Technicians/Engineers/Mechanics) (AMEs) must have good fundamental practical skills and understand the maintenance processes and principles generally used in aircraft hangars and workshops.

In order to be able to perform or supervise "hands-on" tasks of mechanic/technician on the aircraft, the aircraft engines and systems, the AME must have a very complete knowledge of all the tools and associated maintenance processes that are likely to be used in hangars and workshops.

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For future aircraft hangar and workshop technicians, their basic workshop training should commence with *Phase Two — Skills* and should be completed before the students begin working on airworthy aircraft, engines or equipment in *Phase Three — Experience*. For this purpose, the Performance parameters required to meet the Training Objectives outlined in 10.2 of this chapter are divided into two sections: Section a) requires basic manual skills and Section b) refers to the application of these skills to non-airworthy aircraft, components or specially-designed practice rigs. The level of manual skills to be developed also varies according to the category of technicians being trained. For example, bench fitting is of importance to all categories of technicians, while radio technicians may require skills in soldering but they only need an introduction to welding.

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10.1 Basic Workshop and Maintenance Practices: Airframe	Init
10.1.1 Introduction a) Training in workshop practice should begin with exercises in the use of hand tools to make a series of simple shapes to specified dimensions from various metals. Each shape should be progressively more complicated with more precise tolerances. From the start, instructors should ensure that students develop the habit of handling basic hand or machine tools in the correct manner, and action should be taken to correct any bad or potentially dangerous practices before they become habitual. At all times, and particularly during the early stages of training, the importance of producing accurate and careful work must be stressed. These exercises can be used to develop the trainees' inspection ability, i.e. the necessary judgement and sense of responsibility required to assess the accuracy of their own work and that of others. b) It is desirable that licensed AME students should have the opportunity to remove and replace major components. Practice in inspection functions during simulated repair or maintenance activities is considered an important training element in this phase.	
10.1.2 Bench fitting – Cutting and filing: exercises in cutting metal with hacksaws; filing; drilling; drill grinding; thread cutting with taps and dies; and scraping – Measurements: use of steel rule, dividers, calipers, micrometers, vernier, combination set, surface place, and dial test indicator	
10.1.3 Forging, heat treatment, soldering and welding – Forging by hand simple specimens such as chisels, punches and others – Hardening and tempering carbon steel by using forge. – Tin soldering, tinplating, and use of proper flux – Silver soldering and brazing – Welding: oxyacetylene and metallic arc welding of different materials – Inspection of welded joints for flaws	

10.1.4 Sheet metal work – Sheet aluminium alloy: cutting, marking out, drilling, forming, bending, bending allowances, shrinking and flashing. – Forming sheet metal by pressing and rolling – Riveting: types of rivets, riveting with hand tools, rivet spacing, countersinking and dimpling – Use of pneumatic riveting hammer – Blind riveting – Inspection of rivets, removal of rivets, use of oversized rivet and rivet jackets – Tube work: use of taper pins and tubular rivets – Exercises in sheet metal patching and repair work – Heat treatment of aluminium alloy and alloy rivets: use of salt baths and furnaces; annealing and solution treatment	
10.1.5 Woodwork [Elective Subject] – Cutting and smoothing of wood: marking out, sawing and planing wood, and exercises in woodwork involving tenon and scarf joints – Selection of aircraft woods: defects of timber, timber, tests for moisture content, and straightness of grain – Plywoods and laminated woods: bending, patching, and standard repairs to aircraft woodwork. – Gluing: approved glues (casein and synthetic resin); mixing; uses; drying times – Varnishing and protection of aircraft woodwork – Environmental aspects	
10.1.6 Wire and cable work – Inspection of aircraft cables for defects – Splicing exercises – Swaging exercise: attachment of standard end fittings to flying control cables – Demonstration of proof test on flying control cable	
10.1.7 Tube Work – Tube bending, with or without heat treatment – Tube flaring – Fitting of different kinds of unions used in fuel, oil and hydraulic systems – Inspection and testing of tubes and flexible hoses	
10.1.8 Airframe familiarization – Airframe structures: detailed examination of various types of wing and fuselage construction, including primary and secondary structures – Use of forged, extruded, cast and sheet material – Main joints: methods of riveting, spot welding, and adhesive bonding – Doors and cut-outs, positions of inspection panels, removal of fairings, and methods of gaining access to all parts of structure – Landing gear: examination of control system; checking of control surface movements and cable tensions; interconnections of autopilot to control systems; examination (by visiting airline, if necessary) of power-operated control systems	
10.1.9 Ground handling of aircraft – Pre-flight inspection with aircraft on apron – Starting and running of engines and auxiliary power unit (APU); observation of instrument readings; function check(s) of electrical components and radios; stopping of engines – Compass swinging and automatic direction finder (ADF) loop swinging – Use of ground equipment for moving, lifting or servicing aircraft	
10.1.10 Installation and testing of equipment – Removal, replacement, in situ inspection, and function testing – Testing for leaks, errors and electrical faults of electrical equipment, instruments, autopilots, communication and navigation equipment as appropriate	
10.1.11 Small aircraft – Dismantling of aircraft: removal of engine, control surfaces, landing gear, wings, tail plane and fin, and seats – Inspection: inspection of condition of fuselage alignment checks, freedom from distortion, and symmetry – Checking of wings and other airframe components for condition, and freedom from distortion – Reassembly of aircraft: replace wings, empennage, control surfaces, and engine; check rigging angles of wings and tail plane; adjust flying controls and check control surface movements; replace landing gear and check alignment track	
10.1.12 Fabric and dope [Elective Subject] – Exercises in covering frames with hand-sewn fabric; doping; stringing; repairing cuts in fabric; patching	

10.1.13 Wheels and tyres – Complete wheel assemblies: dismantling, inspection (including crack detection of wheels) and reassembly – Inner tubes: puncture repairs – Outer covers: inspection, identification of defects, and spot vulcanizing – Brake units: inspection and salvage of brake pads and discs – Inspection and testing of anti-skid devices	
10.1.14 Control surfaces – Overhaul and repair: repairs to typical fabric-covered and metal-skinned ailerons, and elevators – Hinges and actuating mechanisms: inspection, and renewal of ball races – Correction of mass balance after repair – Adjustment of balance tabs, and servo-tabs on aircraft (to correct for hinge moments and flying faults)	
10.1.15 Multi-engined aircraft – Simulated airline check: familiarization with maintenance schedule – Performance of sequence of major periodic inspection by the students, including signing of check sheets for each job done and recording of and, if possible, rectification of all defects	
10.1.16 Full functioning checks after replacement of components, including ground testing of hydraulic system with retraction of landing gear and function testing of electrical system; ground running of engines; weighing of the aircraft and calculation of centre of gravity.	
10.2 Basic Workshop & Maintenance Practices: Repair, Maintenance and Function Testing of Aircraft Systems/Component	
10.2.1 Hydraulic systems – Demonstration of hydraulic system rig – Dismantling and reassembly of typical components such as hydraulic pumps, regulators, selectors, control valves, accumulators and actuators – Dismantling and examination of control and actuating devices from powered flying control systems – Dismantling, reassembly and recharging of selection of landing gear shock struts, nose-wheel steering mechanisms, anti-shimmy devices and other landing gear components	
10.2.2 Pneumatic systems [Elective Subject] – Demonstration of pneumatic system rig, examination of typical components such as compressors, regulators, selectors and actuators – Dismantling, reassembly and testing of representative selection of pneumatic components: selectors, thrust reversal rams, and others	
10.2.3 Environmental control systems [Elective Subject] – Demonstration of pressurization system models or rigs – Dismantling and reassembly of selected components such as cabin superchargers, mass flow controllers, cabin pressure controllers, discharge valves and safety valves – Demonstration and partial dismantling of cabin heating, cooling and humidifying devices – Dismantling, reassembly and testing of selected components – Familiarization with the servicing and inspection of various types of pressure and mass flow control devices; heat exchangers, combustion heaters and electrical heaters; cold air units (air cycle machines), vapor cycle coolers, cabin temperature sensing and regulating devices; humidifying and dehumidifying equipment; crew and passenger emergency oxygen equipment	
10.2.4 Fire control systems – Inspection, weighing and recharging of fire extinguisher bottles – Demonstration of fire detection and extinguishing system principles by using simulators, individual components, and operation – Practice in controlling aircraft and shop fires – Familiarization with different types of alarm systems, extinguishers and their uses	
10.2.5 De-icing systems [Elective Subjects] – Demonstration of rigs and individual de-icing system components – Dismantling, reassembly and testing of air control devices for mechanical de-icing systems; repairs to inflatable leading-edge overshoes/boots – Hot air systems: overhaul procedures for combustion heaters, and hot air control valves – Repair schemes for air-to-air heat exchangers, and mixing valves – Repair schemes for electrically heated overshoes, and spray-mats	
10.2.6 Miscellaneous systems – Demonstrations and inspection of vacuum systems, water/methanol, drinking and washing water systems – Inspection and tests, as necessary, of fuel system components: cocks, line booster pumps, filters, and refuelling valves	

– Tests and repairs, as necessary, of safety equipment: inspection of dinghies, life jackets, survival kits, safety belts etc.	
10.3 Job/Task Documentation and Control Practices	
10.3.1 Aircraft heavy maintenance check – Preparation for Heavy Maintenance Check: documentation (task/job cards), logbooks, defect records, modification instructions; emptying and inserting fuel tanks, draining oil and other systems; selection and display of equipment; tools required. – Selected major operations: internal inspection of internal tanks; detailed examination of cabin structure followed by pressurization and leak rate test; change of main landing gear – Adherence to aircraft maintenance manual and a typical airline major check schedule for each job – Conclusion of Heavy Maintenance Check: replacement of components, function tests, restoration of internal and external finish, weighing and calculation of centre of gravity, preparation for flight test, and completion of documentation	
10.3.2 Aeroplane or helicopter repair – Selection of repair scheme: damage to be studied and related to approved repair scheme as shown on manufacturers' drawings or structural repair manual (SRM) – Selection of material to be checked for compliance with specification. – Embodiment of repairs according to prepared drawings or SRM – Testing to destruction of selected repair specimens to demonstrate strength of repair – Experience in workshop processes as applicable to repair and reconditioning of aircraft parts (e.g. enlargement or reduction of dimensions to accept oversized or undersized parts; chemical or electro- chemical treatments for the protection of metals; metal depositing processes; special methods of heat treatment; special methods of welding; advanced metal processing techniques, surface texture measurement) – Acceptance tests and final inspection – Completion of documentation	–