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Practical Skill Training for Civil Aircraft Maintenance Personnel

Flight Standard Department

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General Administration of Civil Aviation of China

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Title: Practical Skill Training for Civil Aircraft Maintenance Personnel

1. Basis and Purpose

This advisory circular is established on the basis of Approval of Civil Aircraft Maintenance Organization (CCAR-145-R2), and licensing of Civil aircraft Maintenance Personnel (CCAR-66). It aims at providing a guidance for the training organization on how to build a practical skill training organization. According to the requirements of CAAC, only those personnel having got practical skill training and passing the examination could be eligible for independent maintenance and applying the basic part of the maintenance personnel licensing. The purpose is to improve basic competence of maintenance personnel so as to reduce maintenance error and keep flight safety.

2. Applicability

All training organizations that can provide practical skill training for maintenance staff

3. Cancellation

Intentionally left blank

4. Explanations

The requirement of maintenance personnel training is enhanced and listed individually in CCAR-145R2 Practical skill training for civil aircraft maintenance personnel is one of the most fundamental requirements. Since there were no

uniform training standards for many years, competence of the maintenance personnel vary in different maintenance organizations. It affects the maintenance quality directly. After several recent serious maintenance errors, CAAC are hastened to perform human factor research and to investigate maintenance errors nationally. The investigation result shows that most maintenance errors caused by poor skill. Poor basic knowledge and practical skill of some mechanics incur the maintenance errors directly or indirectly.

In order to improve maintenance personnel skills and reduce maintenance errors, CAAC (Civil Aviation Administration of China) prepare this AC after collecting all advises from airlines and maintenance organizations. This AC gives the requirements of practical skill training and minimum training time thereof.

Note: A maintenance organization can found their training center for own staffs to meet the practical skill requirements of this AC, or choose an training organization approved by CCAR-147. If a maintenance organization training center wants to train maintenance personnel other than their own, it should also get an approval by CCAR-147. In addition, practical skill is one of the qualifications of obtaining work qualification. And work qualification is a prerequisite of application for civil aviation maintenance personnel license. So the practical skill training must be done before getting maintenance personnel license.

5. Practical skill Training Syllabus for Mechanical Maintenance personnel (ME)

5.1 applicability:

A person who hopes to get the initial mechanic work qualification; or a person with work qualification has paused his maintenance job for more than 2 years; other mechanics who need training again.

5.2 Training Purpose:

Let trainees get practical skills of aircraft mechanical maintenance after training, and make them qualified to acquire work qualification.

5.3 Training Items and Requirements:

5.3.1 Aircraft Manuals and Maintenance Documents (Duration: 18 hours)

(1) Training contents:

- a. AMM (Aircraft Maintenance Manual): use of manual, chapter definition, to be familiar with searching components position and their replacement, testing
- b. IPC (Illustrated Part Catalog): use of manual, to be familiar with searching components part number, item number and effectively
- c. Other technical documents in common use: to be familiar with usage and structure of them, as well as their basic contents

(2) Purpose and requirements:

To know about document category, usage and function; can find and use documents

(3) Basic required equipments:

All kinds of maintenance manuals including CD-ROM or hardcopies;

5.3.2 Use of common tools (Duration: 8 hours)

(1) Training contents:

Knowledge of following tools, methods of their correct usages, skills and regulation of tool management and scrapping

- a. Wrenches: open-end wrenches, box-end wrenches, combination wrenches, sockets, ratchets, torque wrenches, Allen wrenches, and applicable practice
- b. Screwdrivers: hand screwdrivers and electrical power screwdrivers (or air driven power screwdrivers) practice, and choosing correct size screwdriver bits
- c. Pliers: duckbill pliers, diagonal cutters, needle nose pliers, slip-joint pliers, vise-grip pliers, safety wire cutter/twister, snap ring pliers, crimping tools, wire stripper, and applicable practice
- d. Other tools for wiring repair: use of soldering iron, hammer, punch, and electrical plugs/receptacles connection practice

(2) Purpose and requirements:

To be familiar with tools usage and attention points; to get correct work methods of parts replacement

(3) Basic required equipments:

Engine, components and parts for practical training; common tools

5.3.3 Use of measuring tools (Duration: 6 hours)

(1) Training contents:

Knowledge of following tools, correct usage, skills and regulation of tool management and scrapping

- a. Vernier calipers, micrometer calipers, dial gauges, feeler gauges
- b. Tensiometers, pressure gauges, spring scales

(2) Purpose and requirements:

To get the rule of accuracy selection, and know about correct reading and usage

(3) Basic required equipments:

Calipers U.S./metric, micrometer calipers, dial gauges, feeler gauges and practical parts for measuring

5.3.4 Use of grease and sealant (Duration: 6 hours)

(1) Training contents:

- a. General replenishing oil and hydraulic fluid
- b. General grease application by gun or hand
- c. Anti-seize compound application
- d. Sealant application methods

(2) Purpose and requirements:

To be familiar with identification of all kinds of grease, lubrication application methods and applicable requirements

(3) Basic required equipments:

Greasing gun and oil filling cart

5.3.5 Locking of fasteners (Duration: 18 hours)

(1) Training contents:

- a. Knowledge of lock wire (safety wiring), practice with twister, and handmade operation
- b. Knowledge of cotter pins and practice
- c. Knowledge of snap rings and practice
- d. Basic operation methods, attention points of lock keys, lock pins

(2) Purpose and requirements:

To get the knowledge of fastener locking and applicable requirements; to be familiar with all methods of locking

(3) Basic required equipments:

lock wire cutter/twisters, needle nose pliers, slip-joint pliers and practical parts

5.3.6 Removal/installation of fasteners (Duration: 12 hours)

(1) Training contents:

- a. General introduction of thread fasteners, and applicable removal/installation
- b. Selection of suitable tools for removal (for example, wrenches)
- c. Correct torque application
- d. Special methods of bolts removal: vibrating with rivet gun; opposite directional drilling thread; using vise-grip pliers; using access panel screw removal tool

(2) Purpose and requirements:

To be familiar with all kinds of fasteners and parts connection; to know about tools category and function; to get basic skills of tools selection and usage (including torque application)

(3) Basic required equipments:

Applicable aircraft, engine, or practical equipments; all kinds of common tools; torque wrenches

5.3.7 Removal/installation of components (Duration: 12 hours)

(1) Training contents:

- a. Replacement of wheels
- b. Replacement of pumps
- c. Replacement of valves
- d. Replacement of motors

(2) Purpose and requirements:

To get knowledge of aircraft jacking; to know about replacement of wheels; to be familiar with inspection of shock struts hydraulic fluid quantity/air pressure and inflation; methods of checking tire pressure and its inflation

(3) Basic required equipments:

Jacks, aircraft, tire pressure gage, air source, shock strut air pressure checking & inflation tools, torque wrenches

5.3.8 Standard practice of tubing and hose (Duration: 24 hours)

(1) Training contents:

- a. Identification of tube, hose and fitting

- b. Replacement of tube, hose and fitting
- c. Replacement of clamps
- d. Swage tube fitting
- e. Leakage checks

(2) Purpose and requirements:

To get knowledge of tube fitting; to be familiar with tubing/hose connection, torque value requirements and flaring tube fitting; to know about removal/installation method of tubing fitting

(3) Basic required equipments:

Tubing cutter, handsaws, reamers, files, marker, square scale, steel scale, tape rule, wrenches, "AN" type flaring tool, "AN" & "MS" type fitting assemblies, bench vise, hydraulic press tester

5.3.9 Removal/installation of control system components (Duration: 12 hours)

(1) Training contents:

- a. Identification of all kinds of cables, cable fittings and turnbuckles
- b. Inspection of control cables corrosion, broken wire, and wear
- c. Lubrication of control cables & pulleys
- d. Practical adjustments of cable tension
- e. Cable cutting, terminal swaging and proof load test
- f. Knowledge of common push-pull rods
- g. Replacements of push-pull rods and applicable adjustment & locking

(2) Purpose and requirements:

To know about cables category and their application; to get skills of cable terminals swaging and checking; to get method of cable tension measuring; to be familiar with inspection of cable damage, corrosion and broken wire; to know about how to lubricate cables; to know about push-pull rods category; to be familiar with replacement of push-pull rods; to get methods of push-pull rods adjustment & locking

(3) Basic required equipments:

Snips, bench vise, cable terminal swaging tool, proof load tester, control cable test bench, tension meter, tools for cable tension adjustment, rigging pins, safety clips and practical training bench

5.3.10 Basic electric wiring (Duration: 30 hours)

(1) Training contents:

- a. Identification of denotations
 - b. Identification of elements and parts
 - c. Use of electronic measurement equipments
 - d. Soldering of elements
- (2) Purpose and requirements:
To be familiar with wiring denotations and identification of elements; to get skills of soldering; to know about how to use measuring equipments
- (3) Basic required equipments
Soldering iron, analog multimeter, digital multimeter, bonding meter, common megohmmeter, pulse megohmmeter, clamp-on ammeter, 2 way oscillograph, function generator

5.3.11 Electric/electronic standard practice (Duration: 30 hours)

- (1) Training contents:
- a. Wiring/cable and their identification
 - b. Wire harness ties and protection
 - c. Connection of terminal clips
 - d. Shield ground wire connection
 - e. Function of alternative wire, searching methods, use rules and applicable treatment
 - f. Installation and measurement of bonding jumpers
 - g. Repair of wire/cable with splices
 - h. Resistance measuring of static dischargers, antennas, wiring and bonding
 - i. Installation of pins/sockets on wire, connection of plugs and receptacles
 - j. Use of crimping tools, their application scope, size selection rules, correct crimping methods, and attention points
 - k. Introduction of how to use SWPM (Standard Wiring Practice Manual)
- (2) Purpose and requirements:
To be able to identify all kinds of wire and connectors; to know about standard practice methods, requirements and wiring/connector protection; to have ability of using all tools; to be familiar with the contents at chapter 20 of SWPM; to have a grip of measuring method of closed circuit, open circuit and insulator resistance

(3) Basic required equipments:

All kinds of terminal clips, heat shrink tubes, cold shrink tubes, ferrules, solder sleeves, terminal stakes, and ground studs

Special tools:

- 1) 59250, 59275 hand crimping tools, or equivalent
- 2) 46673, 49935 hand crimping tools, or equivalent
- 3) M81969/14-01, M81969/14-02, M81969/14-03, DRK20, DRK56-16, DAK20, DAK55-16 contacts insertion/removal tools, or equivalent
- 4) Torque wrench with 0-200 lb-inch range
- 5) Heat gun with power greater than 1000W, reflector, module jig
- 6) M22520/1-01 terminal lug hand crimping tool, or equivalent
- 7) HT210-20 (16) contact hold force tester, or equivalent

5.3.12 Bench working (Duration: 24 hours)

(1) Training contents:

- a. Cutting (handsaw)
- b. Chiseling
- c. Filing
- d. Drilling

(2) Purpose and Requirements:

To be familiar with bench working items; to get skills of cutting, filing and drilling

(3) Basic required equipments:

Flat, handsaw, files, drill presses, dividers, hammers

6. Practical skill Training Syllabus for Avionics Maintenance personnel (AV)

6.1 applicability:

A person who hopes to get the initial avionics maintenance work qualification; or a person with work qualification has paused his maintenance job for more than 2 years; others who need training again

6.2 Training Purpose:

Let trainees get basic practical skills of aircraft avionics maintenance after training, and make them qualified to acquire work qualification.

6.3 Training Items and Requirements:

6.3.1 Aircraft Manuals and Maintenance Documents (Duration: 18 hours)

The same as ME category

6.3.2 Use of common tools (Duration: 6 hours)

(1) Training contents:

Knowledge of following tools, methods of their correct use, skills and regulation of tools management and scrapping

- a. Wrenches: open-end wrenches, box-end wrenches, combination wrenches, sockets, ratchets, torque wrenches, Allen wrenches, and applicable practice
- b. Screwdrivers: hand screwdrivers and electrical power screwdrivers (or air driven power screwdrivers) practice, and choosing correct size screwdriver bits
- c. Pliers: duckbill pliers, diagonal cutters, needle nose pliers, slip-joint pliers, vise-grip pliers, lock wire cutter/twister, snap ring pliers, crimping tools, wire stripper, and applicable practice
- d. Other tools for wiring repair: use of soldering iron, hammer, punch, and electrical plugs/receptacles connection practice
- e. Use of measuring meters (multimeter, megohmmeter, etc)

(2) Purpose and requirements:

To be familiar with tool usage and applicable attention points; to get correct methods of part replacement

(3) Basic required equipments:

Engine, components and parts for practical training; common tools

6.3.3 Use of basic subsidiary material (Duration: 8 hours)

(1) Training contents:

- a. Identification & use of grease
- b. Identification & use of anti-corrosion compound
- c. Identification & use of sealant
- d. Identification & use of lock wire
- e. Identification & use of tape

(2) Purpose and requirements:

To be familiar with correct and safe use of material; to be familiar with

function of lock wire and its practice

(3) Basic required equipments:

Cleaning solvents (such as CRC, MEK); grease, anti-corrosion compound, sealant; lock wire, lock wire cutter/twister

6.3.4 Knowledge of protection of ESDS devices (Duration: 4 hours)

ESDS: Electrostatic Discharge Sensitive

(1) Training contents:

- a. Theory of static discharge
- b. Impairment caused by electrostatic
- c. Electrostatic discharge sensitive identifiers
- d. Precaution of ESDS devices/parts (including printed circuit board) replacements
- e. Transportation of ESDS devices
- f. Protection of ESDS devices
- g. Correct use of wrist strap, and checking

(2) Purpose and requirements:

To know about impairment caused by electrostatic and make correct precaution during normal work

(3) Basic required equipments:

Conductive strip, wrist straps, antistatic papers

6.3.5 Knowledge of electronic device/part, and applicable replacements

(Duration: 12 hours)

(1) Training contents:

- a. Knowledge of navigation, communication and flight instruments, and applicable replacements
- b. Denomination and function of all kinds of display units
- c. Knowledge of all switches, control panels and circuit breakers, and applicable removal/installation
- d. Knowledge of all communication equipments (telephone, microphone) and entertainment devices, and applicable removal/installation
- e. Knowledge of emergency location transmitter and loudspeaker, and applicable removal/installation
- f. Knowledge of all units/cards, and applicable removal/installation
- g. Reading of unit P/N (part number) and S/N (serial number), and

knowledge of unit modification status identifiers

- h. Knowledge of all antennas, and applicable removal/installation
- i. Knowledge of pitot static tube, standby pitot static source, static discharger, vane sensor, TAT (Total Air Temperature) probe, interphone jack, etc
- j. Identification of mark/placard

(2) Purpose and requirements:

To know about configuration of all kinds of electronic equipments and their function; to know about units/cards replacements and readings of P/N, S/N, modification status; to know about importance of emergency system and applicable operational test

(3) Basic required equipments:

Suitable equipments for removal/installation

6.3.6 Electro circuit (Duration: 42 hours)

(1) Training contents:

- a. Knowledge of all electronic elements and symbols
- b. Basic knowledge of diode and applicable measuring
- c. Basic knowledge of transistor and applicable measuring
- d. Basic knowledge of resistor and applicable measuring
- e. Basic knowledge of inductor and applicable measuring
- f. Basic knowledge of capacitor and applicable measuring
- g. Electro circuit measurement

(2) Purpose and requirements:

To know about correct measuring methods of all kinds of electronic elements; to know about electro circuit measuring methods

(3) Basic required equipments:

Multimeter, megohmmeter

6.3.7 Wiring standard practice (Duration: 40 hours)

(1) Training contents:

- a. Measuring of wire conductivity and insulation
- b. Identification of wire type and wire bundles, searching wire/cable P/N; searching WTC (Wire Type Code) from wire list, getting applicable P/N or interchangeable P/N from SWPM chapter 20
- c. Wiring installation, routing, tie and protection

- (a) Applicable area of tie material, and installation method of wiring
- (b) Open wiring, conduit, shield, shield grounding, and wire grounding
- (c) Installation requirement of wiring sleeve
- d. Wiring repair
 - (a) Method of wiring repair
 - (b) Condition about unrepairable wire/cable
 - (c) Crimping splices and detailed wire/cable repair
- e. Methods of wiring shielding, wiring grounding and tool usage
 - (a) Method of shield grounding
 - (b) Pigtail usage
 - (c) Selection of terminal lugs, method of crimping, installation of lug and stake
 - (d) Crimping tool usage
- f. Installation of bus strap, ground block and their identification, measuring
- g. Plugs, sockets, pins
 - (a) Searching plug/socket type, code, P/N; selection of contact insertion/extraction tool
 - (b) Installation of plug/socket
 - (c) Seal of plug
 - (d) Cleaning of connector
 - (e) Crimping pin/receptacle lugs, contact insertion/extraction tool usage; crimping position and size of pin/receptacle lugs; attention points
 - (f) Identification of computer receptacles, pin location, method of pins installation/removal, installation/removal of dowel
 - (g) Making wiring connector, stripping wire insulator, crimping terminal clip, selection and use of stripper/crimping tools, soldering methods and requirements
 - (h) Mark (placard) replacement
 - (i) Replacement of O-ring
- h. Treatment of bonding wire
- i. Function of alternative wire, and its method of searching, use rules and practice

- j. Making high-frequency plugs and coaxial cables
 - k. Burndy block
 - (a) Construction of Burndy block, position identification and installation
 - (b) Use of crimping tool of Burndy block pin, and attention points
 - l. Relays:
 - (a) Identification of relay type
 - (b) Removal/installation of relay socket pin
 - (c) Installation rule of relay and its mark (placard)
 - m. Removal/installation of all kinds of lighted push button switches
- (2) Purpose and requirements:
- a. To be familiar with standard practice of all kinds of wiring and lugs
 - b. To be familiar with all tools
 - c. To be familiar with wiring measurement and routing
 - d. To be familiar with applicable area of tie material
 - e. To be familiar with wiring repair methods and unrepairable condition
 - f. To be familiar with stripper usage
 - g. To be familiar with all crimping tools usage, and use of splices
 - h. To be familiar with function of shielding/grounding wire and their applicable practice
 - i. To be familiar with connection of wiring, and tools usage
 - j. To get soldering skill
 - k. To be familiar with function of O-ring and applicable correct installation methods
 - l. To be able to identify all wire/splice; to get wiring/lugs standard practice experience; to get knowledge of wiring protection & applicable requirement
- (3) Basic required equipments:
- Multimeter, megohmmeter, stripper, crimping tool, blower, bus straps, grounding block, terminal lug, soldering iron, contact insertion/extraction tool, etc; steel scale, snips, knives, needle nose pliers, socket wrenches, box-end wrenches, etc.

7. Flight standard department of CAAC is responsible for the explanation of this AC.

8. This AC becomes effective on April1, 2004.