higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

AIRCRAFT MAINTENANCE THEORY N3

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This marking guideline consists of 10 pages.

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QUESTION 1

1.1 Turnbuckles should be inspected for:
- Corrosion
- Security of attachment
- Bending
- Cracks
- Chafe marks
- Tolerance between turnbuckles and pulleys
- Safety devices to be safe (Any 5 × 1) (5)

1.2 Overloading generally occurs at the tailplane mounting points and must be inspected for:
- Bending
- Twisting
- Popped rivets/broken rivets, screws, bolts
- Security of attachment
- Wrinkling
- Distortion
- Cracks

Check the whole area including vertical stabiliser (fin) for:
- Distortion
- Skin wrinkling
- Popped rivets/broken rivets, screws, bolts
- Cracks (Any 4 × 1) (4)

1.3 Condition of the:
- Glass
- Dial readability
- Pointer visibility
- Casing
- Adjustment knobs (Any 3 × 1) (3)

1.4 Inspect terminals and terminal blocks for:
- Secure mounting
- Secure attachment to terminal block studs
- Condition of the insulating tubing placed over terminals (except pre-insulated types)
- No evidence of overheating and corrosion on connections to terminal block studs
- A maximum of four or three terminal lugs and a bus bar have been connected to any one stud
- No evidence of physical damage to studs, stud threads, and terminal blocks
- Ensure the largest diameter lug is placed on the bottom and the smallest diameter on top
- Stud hole diameter should match the diameter of the stud

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- Terminal lugs have been positioned so that bending of the terminal lug is not required to remove the fastening screw or nut, and movement of the terminal lugs will tend to tighten the connection.

- Cracks:
  - extending from a terminal to any threaded insert
  - extending from a terminal to any other terminal
  - extending over 6,35 mm in length from any terminal in any direction

(Any 3 × 1) (3)

1.5 Inspect the outer cover of the tyres for:
- scuffing
- scalding
- rim chafing
- bead chafing
- bead breaking up
- embedded objects
- cuts/splits
- bulges
- excessive wear
- contamination (sponginess)
- flat spots
- overheating
- grease in bead area
- uneven tread wear
- groove splitting
- opened up tread joint
- impact breaks
- sidewall cracking/splitting (Any 4 × 1) (4)

1.6 Inspect flexible lines (hoses) for:
- secure attachment
- cracks
- cuts
- abrasion/rubbing
- soft spots
- indication of rubber deterioration
- over-tightening of couplings
- pinch marks
- leaks
- hardening of the outer cover

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Inspect tubing for:
- secure attachment
- loose mountings
- abrasion/rubbing
- leaks
- cracks
- scratches
- dents
- over-tightening of couplings
- pinch marks
- kinks (Any 4 × 1) (4)

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QUESTION 2

2.1
- Check the engine against a checking list – checking all component serial numbers and inspecting the general condition.
- Check for damage during transit.
- Remove the sump plug to drain the sump.
- Remove all dummy plugs.
- Remove the surplus oil from the combustion chambers using a syringe.
- Fit the correct type of spark plugs, with the correct reach and heat range.
- Connect the ignition harness from the magnetos to the spark plugs.
- Remove and clean the oil filters.
- Draw all magnetic plugs from sumps and gearboxes to inspect for metal particles.
- Reattach/replace the oil filter and the sump plugs, fitting new crush washers and lock them with wire.
- If necessary, fill the sump with the prescribed grade clean oil. (Any 5 × 1) (5)

2.2 Piston engine propeller check
- Open throttle to run the engine at required r/min.
- Move pitch change lever to course and observe that the r/min drop to the required number and that the pitch changes.
- Move pitch control lever back to fine.
- Depress the feathering button and observe that the r/min drop by 200.
- As soon as the r/min have dropped by 200, pull out the feathering button.
- Check the ammeter charge rate during the checks.
- Record the results. (Any 6 × 1)

OR

Turbine engine propeller check
- Open throttle to the required position.
- Place the pitch change lever in the following positions and observe that the pitch changes to:
  - take off
  - flight idle
  - reverse pitch
  - feathering
- Movement of the lever should be smooth and even, and as soon as the pitch has changed entirely, the lever should be taken back to ground idle.
- Move the feathering control momentarily into feathering position and observe that r/min drop. Move back immediately.
- During each of these checks, monitor the exhaust gas temperature and r/min constantly.
- Record the results. (Any 6 × 1) (6)

2.3
- Silica gel bags
- Dummy plugs filled with silica gel crystals.
- Preservation fluid/oil. (Any 2 × 1) (2)

2.4 Piston engines
- Improper grade of oil.
- Failure of new rings to seat properly.
- Failed or failing bearings.
- Worn piston rings and/or cylinder barrels.
- Worn valve guides.
- Excessive oil leaks past gaskets and oil seals.
- Oil being siphoned from engine in flight.
- Expander in oil control ring improperly installed or lost its tension.
- Oil level too high.
- Oil passing through turbocharger seals (if fitted).
- Worn or broken piston rings.
- Incorrect installation of piston rings.
- External oil leakage.
- Leakage through engine fuel pump vent.
- Leakage at the engine breather or vacuum pump breather.
- Poor quality oil.
- Valve stem seals worn.
- Defective crankcase ventilation.
- Oil released into the cooling system. (Any 4 × 1)

OR

Gas turbine engines
- Oil degradation
- Inefficient de-oiler
- Bearing seal failure
- Scavenge pump failure
- High sump pressures
- Gearbox seal leakage
- Overboard oil loss
- Worn bearings
- Incorrect servicing (Any 4 × 1) (4)

2.5 Piston engines
- Engine fuel filter (strainer) and element
- Fuel pump
- Induction manifold
- Priming pump
- Carburettor
- Fuel injector pump (on engines fitted with fuel injection systems)
- Fuel distributor (on engines fitted with fuel injection systems)
- Injectors (on engines fitted with fuel injection systems)
- Fuel lines (tubing) (Any 4 × 1)

OR

Gas turbine engines
- Engine fuel filter (strainer) and element
- Fuel pump
- Fuel control unit
- Fuel nozzles
- Fuel lines (tubing) (Any 4 × 1) (4)

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QUESTION 3

3.1
- Assure that both magnetos are properly grounded.
- Remove all spark plug harness lead ends from the spark plugs and ground to the engine to prevent ignition.
- In the cockpit, check and ensure:
  - Magneto switch, if separate from starter switch – 'off'.
  - Mixture – 'idle cut-off'.
  - Throttle – 'closed'.
  - Fuel selector – 'off'.
  - Master switch - 'on'.
- Crank engine several revolutions.

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WARNING
Use extreme caution in the area of the propeller while performing this test.

- Impulse coupling operation is audible and can also be felt through the magneto housings. They should click together and consistently while cranking the engine.
- If no clicking or intermittent clicking is discovered, remove the magnetos and service according to the manufacturer's instructions.

(Any 4 × 1 in correct order) (4)

3.2 Inspect needle valves and seats for:

- indications of grooves that have formed
- scratches
- wear
- corrosion
- scoring
- pitting
- ridges
- cracks (Any 2 × 1) (2)

3.3 The type of repair will be determined by the following factors:

- Type of structural material to be repaired (metal, composite, sandwich construction)
- Type of structural component to be repaired (skin, spar, rib, longeron, etc.)
- Type and extent of damage (e.g. fatigue cracks, corrosion, impact damage, etc.)
- Load levels and fatigue spectrum experienced by the structure.
- Material thickness to be repaired.
- The skill of the available labour.
- Availability of repair materials.
- Repair shop facilities. (Any 4 × 1) (4)

3.4

- The seam should be smooth and of uniform thickness.
- The weld should be built up to provide extra thickness at the seam.
- The weld metal should taper off smoothly into the base metal.
- No oxide should form on the base metal at a distance of more than 12 mm from the weld.

- The metal should show no signs of:
  - pitting
  - burning
  - cracking
  - distortion

- The weld should show no signs of:
  - blowholes
  - porosity
  - projecting globules (Any 4 × 1) (5)

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QUESTION 4

4.1
- Symmetry and alignment checks are only done after the other alignment checks have been completed.
- It involves the measuring of elevations and distances between reference points on the aircraft while the aircraft is jacked up and in rigging position.
- These are checked against the established dimensions.
- Dimensions obtained should be recorded on record sheets.
- This check is done by measuring the distance between certain points on the aircraft.
- These points are selected because they are relatively static and because their location will best reflect any misalignment.
- Most manufacturers recommend that the measurements be taken directly from one specified point to another.
- A plumb bob is used to transfer each measurement point to the floor of the hangar, marking the position with chalk.
- This is done by suspending a plumb bob from the check-points and marking the floor immediately under the point of each plumb bob.
- Lower the aircraft and remove the jacks.
- Move the aircraft out of the way so that the measurement of the markings can be done.
- The points on the floor are measured using a steel tape or theodolite. (This method may be easier than trying to measure with a long steel tape on a ladder several feet up in the air.)
- Compare the measurements with the specifications in the aircraft's maintenance manual. (Any 5 × 1 in correct order) (5)

4.2
- Security of attachment
- Free movement
- Alignment
- Correct travel adjustment up and down
- Synchronisation of stick and control surfaces
- Correct connection of electrical bonding
- Correct connection of static dischargers
- Distortion or damage caused during installation
- Missing bolts, nuts, rivets or screws (Any 4 × 1) (4)

4.3
- Leak tester
- Adapter for attachment to pitot head and static vents
- Blank offs (Any 3 × 1) (2)

4.4 It's the centre of gravity of an aircraft in its empty condition.✓ The empty-weight centre of gravity (EWCG) is the centre of gravity of an aircraft in its empty condition (no fuel, oil or other fluids) and is an essential part of the weight-and-balance records that must be kept in the aircraft file.✓ (2 × 1) (2)

Aircraft should be weighed, and centre of gravity determined:
- After initial assembly
- Periodically, like during an annual inspection
- After new equipment has been installed
- After a modification has been made. (Any 2 × 1) (2)

4.5
- Cracks
- Dirty ring grooves
- Dirty or blocked oil holes
- Scoring
- Burning
- Pitting
- Wear
- Warp
- Distortion
- Deformation (Any 4 × 1) (4)

4.6 Approved replacement components and parts:
- Guarantees correct operation and structural strength, which in turn guarantees the safety of the components and parts and the aircraft and its occupants.
- Ensures that all guarantees and warranties remain valid.
- Unapproved components and parts may be acceptable in every way but may be inferior in construction, performance etc. and may fail at any time.
- That means that they may not perform as well or if the same aviation authority approved components and parts and that should be a serious safety concern for everyone.
- If unapproved components and parts are fitted to aircraft it may also void warranties and guarantees of other parts that depend on these components and parts. (Any 4 × 1) (4)

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QUESTION 5

5.1 Move the cockpit controls to check for:
- freedom of movement
- correct cable routing
- correct travel
- backlash
- lost motion (Any 4 × 1) (4)

5.2 Reading of oil in volume
- Equipment required is a graduate sight glass.
- The readings can be taken from a graduate sight glass fitted externally to the oil tank.
- The readings should be taken as laid down, e.g. every 15 minutes.
- The difference between the initial and final readings can be used to calculate the consumption rate, e.g., ml. per hour.

OR

Weighing the mass of the oil
- Equipment required is an 'Avery' weighing machine (scale)
- The tank is fitted to a scale ('Avery' scale or weighing machine)
- Mass readings should be taken as laid down, e.g. every 15 minutes.
- The difference between the initial and final readings can be used to calculate the consumption rate, e.g., kg per hour (4)

5.3
- Remove gearbox sump plug.
- Move the pitch change lever through its full range to bleed air out.
- Reinstall the gearbox sump plug.
- Fit protractor boards on the propeller blades.
- Switch the battery/Master switch to 'on'.
- Move propeller pitch change levers to the following settings:
  - Take off
  - Flight idle
  - Ground idle
  - Reverse pitch
  - Feathering
- Check the travel of the blades on the protractor boards to see that the blades reach the angles for the corresponding pitch lever positions.
- If it is out of limits the necessary adjustments must be carried out to ensure that the blade angles correspond to the actual lever settings.
- Re-check the settings and blade angles.
- During these checks, check for fluid leakage.
- Switch the battery/Master switch to 'off'.
- Remove all equipment and tools used to carry out the checks
- Disconnect the external electrical power supply.
- Carry out the necessary wire locking.
- Refill the propeller with the correct oil if necessary.

(Any 6 × 1 in correct order) (6)

5.4 Inspect the aneroid capsules/bellows for:
- wear
- leakage
- tears
- correct travel
- calibration

Inspect the servo cylinder for:
- leakage
- corrosion
- cracks
- correct mounting
- correct adjustment
- correct connection to throttle linkages

Inspect the servo cylinder tubing for:
- leaks
- loose mountings
- cracks
- scratches
- dents
- pinch marks

(Any 4 × 1) (4)
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TOTAL: 100

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