higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

AIRCRAFT MAINTENANCE THEORY N 3

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This marking guideline consists of 10 pages.

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SECTION A

QUESTION 1

1.1 A
1.2 C
1.3 B
1.4 B
1.5 A

(5 × 1) **[5]**

QUESTION 2

2.1
- Alignment
- Security of attachment
- Corrosion
- Freedom of movement
- Cleanliness
- Lubrication
- Damage to sprocket teeth
- Chafing of components on the guard
- Stretching of chain
- Correct chain tension

(Any 3 × 1) (3)

2.2
- Abnormal extension
- Bow
- Cracks
- Distortion
- Misalignment
- Leakage
- Scoring

(Any 3 × 1) (3)

2.3
- A flight instrument
- A gyroscopic-driven instrument

(2 × 1) (2)

2.4
- A magnetic compass deviation card
- It is found in the aircraft cockpit close to or attached to the magnetic compass.

(2 × 1) (2)

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2.5
- Check its mounting flange for defects, i.e. cracks, distortion, misalignment, etc.
- Inspect mounting studs, nuts, and safety wire for security.
- Check removable units such as ventilation tube, air blast cover, brush inspection band, terminal box, and shield, and conduit for tightness and general mechanical condition.
- Check the generator and cable connections for overheating indicated by discoloration and a burnt odour. (Any 3 × 1) (3)

2.6
- Handle bearings with bearing gloves.
- Never drop bearings, and if it did, send it to the bearing shop for testing.
- Keep bearings lightly lubricated before fitting to a component
- Never hammer or force a bearing.
- Never spin bearings with compressed air.
- Never force the bearing onto a shaft or into a casing – either cool the shaft or heat the casing
- Never clamp a bearing in a vice.
- Always pack bearings with recommended lubricant.
- Never heat a bearing with a naked flame.
- Always use the correct tools when removing, installing and servicing bearings.
- Always use lead-free solvents when cleaning bearings.
- Always keep new bearings in their original wax wrappers to protect them from dust.
- Always keep bearings free from dust.
- Ensure that the bearings are cleaned in a lead-free solvent before it is fitted to a component.
- Keep bearings away from any moisture.
- When fitting a bearing, make sure that bearings fit squarely on the shaft.
- Never turn a bearing at high speed when it is unlubricated. (Any 4 × 1) (4)

2.7
- Leaks
- Cracks
- Security of attachment
- Corrosion
- Wear
- Broken mounting points (Any 3 × 1) (3)

[20]

QUESTION 3

3.1
- Check the engine against a checking list – check all component serial numbers and inspect the general condition.
- Check for damage received during transit.
- Remove the sump plug to drain the sump.
- Remove all dummy plugs.
- Remove the surplus oil from the combustion chambers by means of a syringe.
- Connect the ignition harness from the magnetos to the spark plugs.
- Remove and clean the oil filters.
- Draw all magnetic plugs from sumps and gear boxes to inspect for metal particles.
- Refit the oil filter and the sump plugs, fit new crush washers and lock them with wire.
- If necessary, fill the sump with clean oil. (Any 4 × 1) (4)

3.2
- That all the work has been completed
- That all tools have been removed
- That the engine is correctly installed
- That all the work has been completed and all tools and equipment have been removed
- That there are no loose connections, clamps, screws, bolts and nuts
- That all routing of cables, hoses and controls are properly done
- That the engine and propeller mounting bolts or nuts are secured with wire

(Any 3 × 1) (3)

3.3 Piston engine
- Allow the engine to idle for two minutes.
- With cylinder head temperature within the required limits, the engine can be shut down.
- Move the mixture control “throttle” through idle, cut, off.
- Close the fuel cut-off valves.
- Turn ignition switch off.
- Turn the 'battery' or 'master' switch off. (Any 4 × 1)

OR

Turbine engine
- Ensure throttle is in idle position to allow turbine blades to cool down and allow it to run for 5 minutes.
- Check that the exhaust gas temperature is within limits before shutting the engine down.
- Move throttle or fuel shut-off lever through cut-off position.
- Take the run-down time it takes the engine to decelerate after shut-off right down to turbine standstill.
- Close fuel valves.
- Switch booster pumps off.
- Turn the 'battery' or 'master' switch off. (At least 4 × 1 in correct order) (4)

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3.4
- Gearbox seal failure
- Scavenge pump failure
- High sump pressures
- Gearbox seal leakage
- Overboard oil loss
- Partially or completely worn engine bearings
- Leaking oil passage or pipe
- Incorrect servicing of oil system (Any 2 × 1) (2)

3.5
- Leakage
- Tightness of hose clamps and connectors
- Dents
- Kinks
- Scratches
- Corrosion
- Chafing
- Dents (Any 3 × 1) (3)

3.6
- Apply anti-seize lubricant to the threads sparingly to prevent it from leaking into the cylinder that could cause shorting of the spark plug and grounding the spark.
- Insert the plug into the cylinder and turn it at least three turns by hand.
- Insert a wrench fitting over the hexagon of the spark plug correctly and complete the tightening. (avoiding overtightening by using torque wrench)
- Fit the plug wire (harness) and tighten it with a wrench. (avoiding overtightening by using torque wrench) (Any 3 × 1) (3)

3.7
- Cleanliness of the air screen and orifices
- Leakage
- Cracks
- Corrosion
- Distortion
- Overheating
- Erosion (Any 3 × 1) (3)

[22]

TOTAL SECTION A 47

SECTION B: AIR FRAMES

QUESTION 4

4.1
- Remove all the paint on the area if required.
- Mark out the area to be cut out.
- Cut out the damaged portion of the longeron and remove the rivets concerned.
- Prepare filler from the same material and size of the original damaged longeron to fit into the space where the damaged part was cut out.
- Fabricate an angled support plate with legs of the same length as those of the longeron to be repaired and the full length of the angle to be at least three times the length of the filler.
- Drill the necessary holes into both legs of the supporting angle and the filler (size and spacing should be according to the existing pattern). Hold the filler and supporting angle firmly in position with the supporting angle fitted on the inside of the original angle.
- Attach the parts to the longeron with clamps and drill holes.
- Remove all burrs, nicks and other surface irregularities from both damaged area and repair parts.
- Send both the filler and support angles for chromate treatment to prevent corrosion between the parts.
- Apply zinc chromate primer to all interior surfaces of the repair.
- Complete the necessary riveting.
- Cover the area with protective paint. (At least 5 × 1 in correct order) (5)

4.2 It is the covering of portions of the wood or metal structure that will be coming in contact with the dope✓ to protect it against the solvent actions of the dope (penetration, wrinkling, lifting or dissolving).✓ (2)

4.3
- Plumb bob
- Tape measure
- Theodolite (Any 2 × 1) (2)

4.4 Inspect:

- The header plate flanges for damage and distortion
- The cooler shell for any external damage
- The baffle plates for general damage, particularly tie rods and cooling tube hole
- The water inlet and outlet for corrosion - if pitting is excessive write a report to ensure future monitoring of anti-corrosion additive level
- The cooler supports for damage and cracks.
- The header plate gasket surface for damage or scratches
- The oil drain and vent plugs for thread damage and proper sealing
- The tubes for damage or looseness
- The shell barrel and shell ends for cracks, particularly around inlet and outlet ports
- The welding between cooler body and end shells using magnetic particle crack detection test
- All drain holes for blockage
- All tie rods for thread damage
- The fixed-end tube sheet for thread damage of tie rod holes
- The fixed-end tube sheet for cooling tube hole damage
- The packed-end tube sheet for damage (Any 2 × 1) (2)

4.5

- Compress and extend the strut several times to verify that it operates freely. (The weight of the gear wheel and fork should allow strut to extend.)
- Fill the oleo strut with fluid and inflate the strut to the prescribed pressure with dry air or nitrogen.
- Fit the strut to the test rig and observe that the compression and extension is as required.
- Check gear for alignment and adjust as necessary. (4 × 1) (4)

4.6

- Check for any damage due to negligence or incorrect use of tools or equipment during installation.
- Check that the control system and its components have been correctly assembled and adjusted.
- Check that all locking devices have been made safe.
- Check that the controls have full and free movement, throughout their operating range.
- Check that the cockpit controls and flight control surfaces are synchronised throughout their operating range.
- Check that the trim tab, anti-balance tab or balance tab move correctly in relation to control movement. (Any 4 × 1) (4)

4.7

- To ensure that the instruments provide accurate readings
- To make the necessary adjustments on the instruments due to wear and tear of instrument mechanisms
- To ensure that the pipelines that connect the sensors to the instruments are leak free and unblocked.
- To ensure that moisture that can ice up at high altitude with its very low temperatures is drained out. (Any 2 × 1) (2)

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4.8
- The aircraft is prepared for weighing by emptying it of fuel, oil and anything else that does not form part of the empty weight.
- The tare weight, if there is any, is determined and recorded.
- The aircraft is placed on the scales and levelled.
- The weight is recorded at each scale.
- The empty weight of the aircraft is then determined by subtracting the tare from each scale reading and then added together. (4 × 1 in correct order) (4)

[25]

TOTAL SECTION B 25

SECTION C: ENGINES

QUESTION 5

5.1
- Position the component between the two heads of the machine and clamp it there.
- Select the required current intensity.
- Depress the push-button on the apparatus for approximately one second to magnetise the component.
- Spray detecting ink over the component.
- Look for any concentration of magnetic particles of the detecting ink on the component.
- Any crack or defect results in a distortion of the normal magnetic field and is invisible to the naked eye.
- When the detecting ink is sprayed over the component, the magnetic particles of the ink are influenced by the magnetic field and is concentrated in the area of maximum intensity which is between the poles formed by the defect.
- The defect is clearly indicated and can then be treated as necessary.
- It may be necessary to view the component under a black light if the fluorescent solution is used.
- If no defects are found, clean and demagnetise the component.

(At least 8 × 1 in correct order) (8)

5.2
- Cracks
- Nicks
- Indentations
- Corrosion
- Fretting
- Wobble
- Erosion
- Overheating (Any 2 × 1) (2)

5.3 Check the engine control system (throttle control, oil cooler shutter control, propeller, pitch change control, mixture control, cowl flap or engine cooling shutter control) for the following:

- Ease of operation
- Correct cable routing
- The correct amount of static friction
- Lost motion
- Correct synchronisation of the cockpit controls and the components that they are attached to (Any 4 × 1) (4)

5.4

- r/min gauge
- Vacuum gauge
- Oil pressure gauge
- Auxiliary oil pressure gauge
- Fuel pressure gauge
- Oil inlet temperature gauge
- Oil outlet temperature gauge
- Cylinder head temperature gauge
- Cooling temperature gauge
- Cooling air speed indicator
- Fuel flowmeter
- Air intake temperature gauge
- Exhaust back pressure gauge
- Test house barometer (hg)
- Air intake pressure (hg) (Any 3 × 1) (3)

5.5

- Remove gearbox sump plug.
- Move the pitch change lever through its full range to bleed air out.
- Refit gearbox sump plug.
- Fit protractor boards on the propeller blades.
- Turn the battery/master switch on.
- Move propeller pitch-change levers to the following settings:
  Take off, flight idle, ground idle, reverse pitch and feathering.
- Check the travel of the blades on the protractor boards to see that the blades reach the angles for the corresponding pitch lever control positions.
- If it is out of limits, the necessary adjustments must be carried out to ensure that the blade degrees correspond to the actual lever settings.
- If unnecessary, re-check the settings and blade angles.
- During these checks, check for leakage past seals and O-rings.

(Any 4 × 1) (4)

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5.6
- Start the engine and observe oil pressure. Should oil pressure not rise to 10 psi within 5 seconds, shut engine down and investigate the cause.
- When proper oil pressure is reached, idle the engine for 5 minutes.
- Allow the oil temperature to stabilize at 49°C and the oil pressure above 68 kPa. Stay within the minimum and maximum limitations.

NOTE:

- Blue or white smoke may appear from the exhaust during initial start and run-up. Unless the smoke is extreme or appears in combination with an oil pressure drop, it can be considered normal. Lubricants used in assembly may make light smoke for up to 30 minutes operation.
- Advance the throttle slowly in 500 r/min increments until take-off power is reached.
- Pause at each r/min step and allow the engine to stabilize (the turbocharger will lag slightly).
- At each r/min step, observe oil pressure, oil temperature, turbine inlet temperature/exhaust gas temperature, and manifold pressure. These indications should not fluctuate but remain steady. Oil pressure above idle should be a minimum of 207 kPa. Take care not to "over-boost" the engine when approaching take-off power, throttle movement at power is sensitive.
- Move the throttle slowly to back to idle. Great care should be taken not to reduce power rapidly.
- On engines fitted with turbosuperchargers that cannot be shut down immediately, operate the engine at idle for 3 to 5 minutes to allow the turbine wheel to slow down.
- Shut down the engine and inspect for oil leaks and general security. If installed, tap V-band coupling to assure seating and re-torque nut.

(At least 7 × 1 in correct order) (7)
[28]

TOTAL SECTION C: 28

TOTAL: 100

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