higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

AIRCRAFT MAINTENANCE THEORY N2

9 APRIL 2018

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 B
1.2 A
1.3 B
1.4 A

(4 × 1) **[4]**

QUESTION 2

2.1
- When the angle of attack changes from 4° to ±15° lift will increase.
- If the angle increases beyond 15°, lift will rapidly decrease.
- If the angle is decreased from 4° to a negative angle, the lift will also decrease. (3)

2.2
- Wing tip fuel tanks
- Notches on wing leading edges
- Wing fences
- Shark tooth on wing leading edges
- Vortex generators
- Winglets
- Raked wing tips
- Wing tip fences (Any 2 × 1) (2)

2.3
- Fibre-tipped pen especially when working on aluminium
- Graphite pencil provided it's not used on aluminium (it can cause corrosion)
- Scriber (Any 2 × 1) (2)

2.4 2.4.1 A – Bulkhead
B – Formers/frames/hoops/reinforcing rings (Any 2 × 1) (2)

2.4.2 Monocoque fuselage construction (1)

2.5
- The engines are usually mounted with their thrust line parallel to the longitudinal axis.
- Make markings on the floor under the engine on the points specified in the instruction manual, using a plumb bob.
- Make markings on the floor under the fuselage on the points specified in the instruction manual, using a plumb bob.
- Measure the distance between the two lines marked off on the floor. This check can also be done when doing the symmetry check.
- Compare the distances to those specified in the instruction/maintenance manual. (5)

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2.6
- Heat the metal to 400 °C for 20 minutes.
- Soaking times in the furnace will be different for different alloys and thickness of metal.
- Remove from furnace and allow to air-cool. (3)

2.7 Look for change in colour:
- Steel – reddish brown powder.
- Aluminium and its alloys – white or grey powder
- Copper – greenish powder (3)

2.8 It can be detected using equipment that can show what is inside the material, such as X-rays✓ or ultrasonic waves.✓ (2)

2.9 NO TREATMENT!! Remove the part and replace it with a new one. (1)
[24]

QUESTION 3

3.1 A – Adjustment screw
B – Spring/compression spring/coil spring
C – Inlet port
D – Ball (and seat)/valve (4)

3.2
- It is to protect the engine-driven pump and hydraulic system.
- The shear section of the drive coupling, located midway between two sets of splines, is smaller in diameter than the splines. If the pump becomes unusually hard to turn or becomes jammed, this section will shear, preventing damage to the pump or driving unit. (2 × 1) (2)

3.3
- Hydraulics deals with fluid media and is not as compressible whereas pneumatics operates with air that is compressible.
- Hydraulics is moving and operating equipment with oil under pressure, pneumatics is air under pressure.
- Hydraulics is applied in high-load applications whereas pneumatics is applied in low-load applications.
- Pneumatic systems work faster than hydraulic systems.
- Hydraulic systems require oil whereas pneumatic systems require air for operation.
- Pneumatic cylinders operate in open-ended circuits, with the compressed air exhausting to the atmosphere. Normal hydraulic circuits operate in a re-circulating or closed circuit.
- Pneumatic systems are generally much cheaper regarding operating costs compared to hydraulic systems.
- Hydraulic systems are self-lubricating whereas pneumatic systems normally require the introduction of lubricant in the form of oil mist or oil spray. (Any 3 × 1) (3)

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3.4
- External leaks may be detected by applying a solution of soapy water (non-soda) to unions or joints where leaks are suspected.
- Bubbles will appear where leakages are present. (2 × 1) (2)

3.5
- The structure of the fuselage has to be made sufficiently strong to withstand the internal pressure, which increases the mass and the cost of the aircraft.
- Additional intricate equipment is required to provide pressurisation, which increases the initial cost of the aircraft as well as adding to its mass reducing its payload.
- All additional equipment requires extra maintenance that also increases the cost.
- The majority of the methods incorporated to provide air for pressurisation, draws power from the engines. (4)

3.6 All pressurised aircraft requires some form of a negative pressure-relief valve that opens when outside air pressure is greater than cabin pressure to prevent accidentally obtaining a cabin altitude that is higher than the aircraft altitude. (2)

3.7
- Bleeding hot air from the turbine engine compressor
- Using engine exhaust heat exchangers
- Ramming air heated by combustion heaters (3)

[20]

QUESTION 4

4.1
- Primary zone – combustion air
- Secondary zone – dilution air
- Tertiary zone – cooling air (3)

4.2 4.2.1 Turbine section (1)

4.2.2
- Turbine wheel/disk
- Turbine blades and nozzle guide vanes (2)

4.2.3 The function of the turbine is to transform a portion of the kinetic (velocity) energy✓ of the exhaust gases into mechanical energy✓ to drive the compressor and accessories. (2)

4.3
- Intake
- Compression
- Expansion
- Exhaust (4)

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4.4
- Allow ease of flow under all operating conditions.
- Allow quick starting of the engine.
- Have a high calorific value.
- Provide complete combustion under all conditions.
- Be non-corrosive.
- Byproducts of combustion should have no harmful effect on the flame tubes and turbine section.
- Be a minimum fire hazard.
- Be available in large quantities.
- Must be inexpensive.
- Must be readily available. (Any 2 × 1) (2)

4.5
- Piston and cylinder head failure due to high pressures acting on overheated parts
- Lubrication failure due to oil breakdown under high temperature
- Valve and valve seat burning and warping
- Burnt or damaged pistons
- Broken piston rings
- Cylinder hold down stud or cap screw failures
- General overloading of bearings and other engine part (Any 2 × 1) (2)

4.6
- Main metering
- Idling
- Accelerating
- Mixture control
- Idle cut-off
- Power enrichment or economiser (Any 4 × 1) (4)

4.7
- The supercharger takes its power from the crankshaft.
- The turbocharger draws power from exhaust gases that result from combustion. (2)

4.8
- There is a more even distribution of the fuel-air charge to the cylinders.
- There is a more complete vaporisation of the fuel due to whirling action of the impeller as well as the heat of compression.
- There is a rise in temperature which reduces the density of the charge.
- There is absorption of power by the supercharger mechanism. (Any 2 × 1) (2)

[24]

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QUESTION 5

5.1 The pilot can change the pitch of the propeller in flight or while operating the engine on the ground by means of a pitch-changing mechanism✓ that may be mechanically (manually), hydraulically or electrically operated.✓✓ (3)

5.2 5.2.1 It is determined by using a formula which involves dividing the (measured) output power by the (calculated) input power and then multiplying it with 100 to express it as a percentage.✓✓

5.2.2 No.✓ There are no machines with 100% efficiency. This is due to various losses i.e. friction and cooling incurred in getting the output.✓ (2 × 2) (4)

5.3
- Switch battery or master on.
- Turn fuel valves on.
- Switch booster pumps on and check gauge to ensure that fuel is delivered.
- Prime engine for the recommended period.
- Open throttle to idle, start or prescribed position depending on engine type.
- Close cowl flaps fully if applicable.
- Turn ignition switch to both.
- Depress starter button to rotate engine until the engine fires and starts to run. (8)

5.4 5.4.1 Inspect for cracks, defects and condition of bearings.

5.4.2 Inspect for wear and cuts and other defects.
(2 × 1) (2)

5.5 5.5.1 Water vapour weighs less than air and as a result the weight of the air will be reduced resulting in a decrease of thrust.

5.5.2 A decrease in density will reduce the weight of the air entering the engine✓ and as a result there will be a decrease in the output power of the engine.✓
(2 × 2) (4)
[21]

QUESTION 6

6.1 Gyroplane
The gyroplane has a more conventional fuselage, is equipped with a conventional propeller to produce thrust✓, has an empennage and may have stub wings.✓

Helicopter
The helicopter has no propeller for producing forward thrust, but relies solely on its rotor for lift and thrust✓. A small rotor is provided at the tail to counter balance the torque of the main rotor.✓ (4)

6.2 The main rotor blades are the aerofoil section rotating with the main rotor head producing lift as they move through the air✓. (1)

6.3 When a force is applied to a spinning gyro,✓ the reaction occurs 90° later in the direction of rotation.✓ (2)
[7]

TOTAL: 100

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