AIRFRAME & POWERPLANT MECHANICS

POWERPLANT TEST GUIDE

Written, Oral, and Practical

ALIGNS WITH

FAA-H-8083-32B & FAA-H-8083-32B-ATB

Airframe & Powerplant Mechanics Powerplant Handbook

2025 EDITION

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QUESTIONS

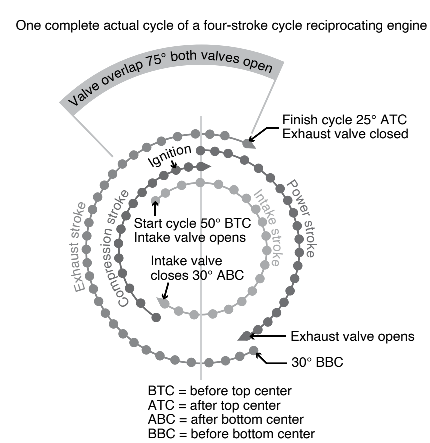
1-19 AM.III.A.K5
Which of the following is a characteristic of a thrust bearing used in most radial engines?
A. Tapered Roller
B. Double-Row Ball
C. Deep-Grooved Ball

1-20 AM.III.A.K2
What is the primary advantage of using propeller reduction gears?
A. To enable the propeller RPM to be increased without an accompanying increase in engine RPM.
B. To enable the engine RPM to be increased with an accompanying increase in power and allow the propeller shaft to remain at a lower RPM.
C. To enable the engine RPM to be increased with an accompanying increase in propeller RPM.

1-21 AM.III.M.K7
On a smaller aircraft engine with a keyed propeller shaft, to what is the keyway aligned with during installation of the propeller?
A. Number 1 cylinder at bottom dead center.
B. Number 1 cylinder at top dead center.
C. The magneto firing point for the number one cylinder.

1-22 AM.III.A.K2
During the power stroke of a four stroke engine, which are correct positions of the valves?
A. Intake valve is open, exhaust valve is closed.
B. Intake valve is closed, exhaust valve is open.
C. Both the intake and exhaust valves are closed.

1-23 AM.III.A.K2
On which stroke are both valves on a four-stroke cycle reciprocating engine open?
A. Power and exhaust.
B. Intake and compression.
C. Intake and exhaust.



Valve timing chart.

ANSWERS

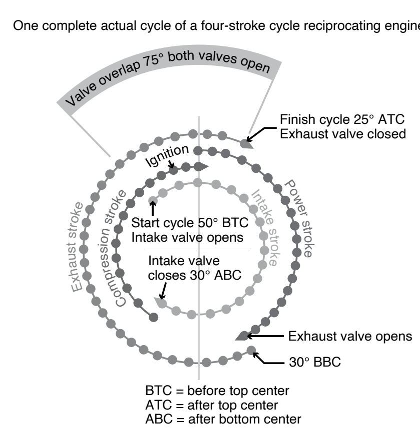
1-19 Answer C
Special deep-grooved ball bearings are used to transmit propeller thrust and radial loads to the engine nose section of radial engines. This type of bearing can accept both radial and thrust loads with minimal friction.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 22

1-20 Answer B
Increased brake horsepower of an engine results partially from increased crankshaft RPM. However, increasing crankshaft RPM without regard to propeller speed can cause propeller inefficiency-as propeller tip speed approaches the speed of sound, the prop becomes less efficient. Reduction gearing allows the engine RPM to be increased to extract maximum power while rotating the propeller at a slower speed than the crankshaft.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 23

1-21 Answer B
The propeller shaft of most low power engines is tapered and with a milled slot so that the propeller hub can be keyed to the shaft. The keyway position is in relation to the top dead center position of the number 1 cylinder.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 23

1-22 Answer C
The four-strokes plus the ignition event are the five events of a four-stroke cycle engine. In order of occurrence, the 5 events are: The Intake Stroke, The Compression Stroke, Ignition, The Power Stroke and The Exhaust Stroke. During the intake stroke, the crankshaft rotates and the piston moves down away from the top of the cylinder. As it does, it draws in a gaseous fuel/air charge through an open intake valve. As the piston nears the bottom of the cylinder, the intake valve closes and the piston reverses direction to begin the compression stroke. The fuel/air charge, trapped between the piston and the cylinder walls, compresses as the piston moves upward toward the cylinder head. Just before top center of the stroke, the spark plug fires which lights off the compressed charge. The energy released by the burning of the fuel air mixture forces the piston down toward the bottom of the cylinder during the power stroke--the heat energy is thus transferred to the crankshaft. The exhaust valve opens and the burnt gases are forced out of the cylinder as the piston returns to the top of the cylinder during the exhaust stroke.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 25

1-23 Answer C
The valve timing chart below (Figure 1-37 of FAA-H-8083-32) illustrates when the valves open during the four stroke of the engine and upon what strokes both valves are open at the same time, which is known as valve overlap. On a typical reciprocating engine, the intake valve opens just before the piston reaches TDC (top dead center) on the exhaust stroke. The exhaust valve opens just before the exhaust stroke begins and stays open until a little after the exhaust stroke is complete. This means the exhaust valve is open as the intake stroke begins, so both valves are open during a part of the exhaust stroke and a part of the intake stroke.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 26



Valve timing chart.

1-24 AM.III.A.K2
If fuel/air ratio is proper and ignition timing is correct, the combustion process should be completed
A. 20˚ to 30˚ before top center at the end of the compression stroke.
B. when the exhaust valve opens at the end of the power stroke.
C. just after top center at the beginning of the power stroke.

1-25 AM.III.A.K2
The actual power delivered to the propeller of an aircraft engine is called
A. friction horsepower.
B. brake horsepower.
C. indicated horsepower.

1-26 AM.III.A.K2
The compression ratio of an engine is equal to
A. the volume of the cylinder multiplied by the manifold pressure.
B. the volume of the combustion chamber multiplied by the manifold pressure.
C. the volume of the cylinder with the piston at BDC divided by the volume of the cylinder at TDC.

1-27 AM.III.A.K2
During a 4 stroke cycle, which of the following event occurs at about 60º BDC?
A. The exhaust valve opens.
B. Ignition occurs.
C. The intake valve closes.

1-28 AM.III.A.K2
How many of the following are factors in establishing the maximum compression ratio limitations of an aircraft engine?
1. Detonation characteristics of the fuel used.
2. Design limitations of the engine.
3. Degree of supercharging.
4. Spark plug reach.
A. 4
B. 2
C. 3

1-29 AM.III.A.K2
The horsepower developed in the cylinders of a reciprocating engine is known as the
A. shaft horsepower.
B. indicated horsepower.
C. brake horsepower.

ANSWERS

1-24 Answer C
The time of ignition varies from 20° to 30° before TDC (depending upon the requirements of the specific engine) to ensure complete combustion of the charge by the time the piston is slightly past the TDC position.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 26

1-25 Answer B
Indicated horsepower is the term used to describe the theoretical output of an engine. The total horsepower lost in overcoming friction (friction horsepower) must be subtracted from the indicated horsepower to arrive at the actual horsepower delivered to the propeller by the engine. This is known as brake horsepower.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 31

1-26 Answer C
All internal combustion engines must compress the fuel/air mixture to receive a reasonable amount of work from each power stroke. The fuel/air charge in the cylinder can be compared to a coil spring. The more it is compressed, the more work it is potentially capable of doing. A comparison of the volume of the cylinder at Bottom Dead Center (BDC) and at Top Dead Center (TDC) of a stroke describes the amount of compression developed. Compression ratio is a controlling factor in the maximum horsepower developed by an engine.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 29

1-27 Answer C
The intake valve is timed to close at about 50-75º past BDC on the compression stroke to allow the momentum of the incoming gases to charge the cylinder more completely. The exhaust valve opens at about 135º on the exhaust stroke. Ignition occurs at approximately 20º before TDC of the compression stroke.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 25-26

1-28 Answer C
Manifold pressure is the average absolute pressure of the air or fuel air charge supplying the engine. Combined with the compression ratio, the total pressure inside the combustion chamber of the engine is determined. Design limitations prevent unlimited pressure inside the engine. Since supercharging affects manifold pressure and fuels have various characteristics which affect their ability to be compressed without exploding, these three factors limit the maximum compression ratio that can be developed by an engine. The reach of the spark plug will affect the ignition of the compressed charge in an engine that has already been designed with the other three factors taken into consideration, however it does not affect maximum compression ratio.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 29

1-29 Answer B
The indicated horsepower produced by an engine is the horsepower calculated from the indicated mean effective pressure and other factors which affect the power output of an engine. Indicated horsepower is the power developed in the combustion chambers without reference to frictional losses of the engine. This horsepower is calculated as a function of the actual cylinder pressure recorded during engine operation.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1 Page 30

ANSWERS

ORAL EXAM

1-7(O). For an engine to develop high power, an increase in crankshaft rotational speed is required. However as propeller tip speed approaches the speed of sound, efficiency is greatly reduced. Propeller reduction gearing is used to allow the engine to turn at a high RPM while keeping the propeller speed lower and efficient. The propeller is geared to the engine crankshaft in such a way as to make the propeller not turn as fast as the engine. There are three common types of reduction gearing: spur planetary, bevel planetary, and spur and pinion.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1

1-8(O). A gas turbine engine is an internal combustion engine. Like a reciprocating engine, the functions of intake, compression, combustion, and exhaust are all required. The difference is that, in a turbine engine, these functions happen in dedicated sections of the engine and they happen continuously. Air is taken in at the front of the engine and is compressed in the compressor section, either axially or centrifugally. From there it is sent through a diffuser to the combustion section where fuel is discharged and combustion takes place. The energy in the fuel is released and is directed into the turbine section. Turbine wheel(s) extract the energy in the burning fuel. Depending on the engine type, the energy is converted into rotational mechanical energy to operate the engine and create thrust by turning a fan, propeller, or rotor. In turbojet engines, just enough energy is extracted to operate the engine and the remainder is directed out of the exhaust of the engine to be used as thrust.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1

1-9(O). The thermal efficiency of a gas turbine engine is a prime factor in performance. This is the ratio of the net work produced by the engine to the chemical energy supplied in the fuel. The turbine inlet temperature, compression ratio, and component efficiencies are the three most important factors affecting thermal efficiency. Other factors are compressor inlet temperature and combustion efficiency. A high turbine inlet temperature will result in higher efficiency and more power. However, temperature limits must be adhered to or the turbine section can be overheated and destroyed. If the efficiency of the engine components is reduced, then engine performance will reduce. So, damaged or worn components will produce performance losses. Also, if the stagnation density (a combination of airspeed, altitude, and ambient temperature) is reduced, the performance is reduced. This results from the reduced mass of air flowing through the engine.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1

1-10(O). The diffuser is the divergent section of the engine after the compressor and before the combustion section. It functions to reduce the velocity of the compressor discharge air and increase its pressure so that it can be combined with fuel and burned in the combustion section. The lower velocity of the gases aids in the continuous burning process. If the gases pass through the combustion section at too high of a velocity, the flame could extinguish.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 1

1-11(O). A typical APU is a turboshaft gas turbine engine that is made to transfer horsepower to a shaft. The shaft turns the engine compressor from which bleed air for the aircraft is obtained. It also drives an accessory gearbox that rotates a generator. The generator supplies the aircraft with electrical power on the ground and in the air. The APU is often operated with no personnel on the flight deck.
Ref: Powerplant Handbook H-8083-32B-ATB Chapter 10 Page 58, Chapter 9 Page 19, Chapter 1

PRACTICAL EXAM

1-1(P). Given an actual aircraft reciprocating engine or mockup, measure the valve clearance with the lifters deflated and record your findings. [Level 2]

1-2(P). Given an actual aircraft reciprocating engine or mockup, accomplish a compression test, and record all findings. [Level 3]

1-3(P). Given an actual aircraft reciprocating engine or mockup, inspect engine control cables for proper rigging and record your findings. [Level 3]

1-4(P). Given an actual aircraft reciprocating engine or mockup, inspect engine push-pull tubes for proper rigging and record your findings. [Level 3]

1-5(P). Given an actual aircraft reciprocating engine or mockup, inspect ring gap and record your findings. [Level 3]

1-6(P). Given an actual aircraft reciprocating engine or mockup, install piston rings on a piston and record maintenance. [Level 3]

1-7(P). Given an actual aircraft reciprocating engine or mockup, install an aircraft engine cylinder and record maintenance. [Level 3]

1-8(P). Given an aircraft engine component and appropriate publications, inspect dimensionally and record your findings. [Level 3]

1-9(P). Given an actual aircraft reciprocating engine or mockup, component, and appropriate publications, install the component and record the maintenance. [Level 3]

1-10(P). Given a turbine engine compressor blade and appropriate publications, complete a repair by blending and record maintenance. [Level 3]

1-11(P). Given an actual aircraft turbine engine or mockup, component, and appropriate publications, install the component and record the maintenance. [Level 3]

1-12(P). Given the required information, calculate the cycle life remaining between overhaul of a turbine engine life limited component. [Level 2]

1-13(P). Given an actual aircraft turbine engine or mockup and appropriate publications, check the rigging of a turbine engine inlet guide vane system and record your findings. [Level 3]

1-14(P). Given an actual aircraft turbine engine or mockup and appropriate publications, measure a compressor or turbine blade clearance and record your findings. [Level 3]

1-15(P). Given an actual aircraft turbine engine or mockup, appropriate publications, and an unknown discrepancy, troubleshoot a turbine engine and record your findings. [Level 3]