BE-1900 Systems

Airline Transport Pilot Oral Exam Guide—BE-1900 Systems
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The following questions reference the Beechcraft 1900-C systems. These questions are representative of what you are required to know about your aircraft systems. Review your aircraft's AFM for answers specific to the airplane your checkride will take place in.

The blank lines can be used to document the information for aircraft you will be flying or testing in other than the BE-1900.

A. Airframe

1. **Describe the airframe of the BE-1900.** (AFM)

   Low-wing monoplane constructed of metal with fully cantilevered wings and a T-tail empennage.

   ____
   ____
   ____

2. **What are the general dimensions of the BE-1900?** (AFM)

   Wingspan — 54 feet 6 inches ____________________

   Length — 57 feet 10 inches ____________________

   Tail height — 14 feet 11 inches ____________________

3. **Describe the aircraft seating arrangement.** (AFM)

   Seating is available for 19 passengers plus crew.

   ____
   ____

4. **Where are the baggage compartments located and what is the maximum amount of weight allowed in each?** (AFM)

   Nose — located in nose and accessed by opening a door on left side of fuselage; unpressurized and accommodates 150 lbs of baggage. *Forward cabin* — located opposite forward door and aft of the crew compartment. 250-lb weight capacity. Hangar in compartment: 100 lbs.

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Aft—located at the rear of the cabin; separated from passenger compartment by a solid bulkhead; 880 pounds forward of cargo net and 630 pounds between cargo net and aft bulkhead.

5. Where are the emergency exits? (AFM)

Three emergency exit doors are provided. One is located on the left side of the fuselage at the trailing edge of the wing. The other two are located on the right side of the fuselage at the leading and trailing edges of the wing.

B. Flight Controls

1. Describe how the ailerons, elevators and rudders are operated. (AFM)

Conventional push-pull control wheels interconnected by a T-column operate the ailerons and elevators. The rudder is operated by rudder pedals, which are interconnected by linkages below the floor. All three systems are connected to their respective control surfaces through push rod and cable-bellcrank systems.

2. What trim tabs are provided? (AFM)

Adjustable trim tabs are located on the rudder, elevator, and ailerons. Trim tab controls are located on the center pedestal. All trim tabs can be manually adjusted. The elevator trim can also be adjusted electrically by moving a thumb switch on each control wheel. An ELEV TRIM ON/OFF is located on the pedestal.

3. What is the function of the yaw damper system? (AFM)

The yaw damper senses heading changes (compass system input) and corrects, through use of a servo, by deflecting the rudder in the necessary direction and stabilizing the yaw axis of the airplane.

C. Annunciator System

1. What does the annunciator system consist of? (AFM)

a. *Warning annunciator panel*— centrally located on glareshield panel, red readout.

b. *Caution/advisory annunciator panel*— on center subpanel with yellow caution lights and green advisory lights.

c. *Two red master warning flashers*— on glareshield directly in front of each pilot.

d. *Two yellow master caution flashers*— inboard of the master caution flashers.

e. *Press-to-test switch*— to the right of warning annunciator panel.

2. If a fault occurs that requires immediate attention, what indicator lights will illuminate? (AFM)

a. Appropriate red warning flasher in the warning annunciator panel illuminates.

b. Both master warning flashers begin flashing.

c. Illuminated light in warning annunciator panel remains illuminated until fault is corrected.

d. Master warning flashers can be extinguished by pressing the face of either flasher (even if fault has not been corrected). Will illuminate again if another warning annunciator illuminates.

3. If a fault occurs that requires attention but not immediate action, what indicator lights will illuminate? (AFM)

a. Appropriate yellow caution flasher in the caution/advisory panel illuminates.

b. Both master caution flashers begin flashing.

c. Illuminated caution annunciator in the caution/advisory annunciator panel remains illuminated until fault is corrected.

d. Master caution flashers can be extinguished by pressing the face of either flasher (even if fault has not been corrected). Will illuminate again if another caution annunciator illuminates.

4. When will the annunciator panel automatically go into "dimming" mode? (AFM)

The annunciator panel will automatically activate the dimming mode when all of the following conditions are met:

a. A generator is online.

b. The overhead floodlights switch is in the OFF position.

c. The pilot flight lights switch is in the ON position.

d. The ambient flight level in the cockpit is below a preset value.

D. Flaps

1. Describe the flap system. (AFM)

A four-position single-slotted flap system is provided, two on each wing. One is located on the outboard wing panel and one is located on the center section. Each individual flap is mounted on two tracks attached to the rear wing spar. Anti-friction rollers attached to the flap roll in the slots provided in the flap tracks.

2. How are the flaps operated? (AFM)

An electric motor powers a gearbox located on the forward side of the rear spar at the centerline of the aircraft. The gearbox turns four flexible driveshafts coupled to jackscrews, one of which operates each flap.

3. **What are the different flap settings?** (AFM)

   Four detents: UP, TAKEOFF, APPROACH, LANDING. Intermediate flap positions not available.

4. **Which generator bus provides power to the flap motor?** (AFM)

   The left generator bus.

5. **What protection is provided in the event of a flap asymmetry?** (AFM)

   Power is automatically disconnected to the flap motor in the event of a malfunction that would result in any flap being three to six degrees out of phase with the other flaps.

E. Landing Gear

1. **Describe the main and nose gear assemblies on this aircraft.** (AFM)

   The main gear consists of a conventional air-oil strut which pivots between main structural ribs on the nacelle and retracts forward into the nacelle. The nose gear consists of a conventional air-oil strut installed in the nose which pivots on two longitudinal fuselage members and retracts aft.

2. Describe the hydraulic extension and retraction of the landing gear. (AFM)

Extension and retraction is accomplished by using actuators located on each gear assembly powered by the hydraulic system. The system's electric motor drives a hydraulic pump, which directs hydraulic fluid to the extension or retraction side of the hydraulic actuators. The system is pressurized to 3,000 psi.

3. What methods are used to prevent accidental gear retraction while on the ground? (AFM)

a. A safety switch is located on the right main landing gear that opens a control circuit when the gear strut is compressed.

b. A mechanical down lock hook holds the landing gear handle in the "DOWN" position. The hook automatically disengages when the airplane leaves the ground. It can be manually overridden in case of a malfunction, by pressing the red downlock release button.

4. What indicating system is used to advise the pilot of the gear position? (AFM)

Landing gear position is provided by individual green GEAR DOWN indicator lights located on the pilot's right subpanel, labeled NOSE, L and R. A red in-transit light is also provided, located inside the clear landing gear control handle.

5. **What conditions will result in the gear horn sounding and the red lights in the landing gear control handle to illuminate?** (AFM)

The warning horn will sound and the landing gear control handle lights will illuminate if the flap control handle is positioned up or down, to and including APPROACH and either or both power levers are retarded with the gear not down and locked. The red lights in the handle will also illuminate when the gear is in transit, the gear is unsafe (microswitches do not agree with position of gear handle), or when the power levers are below a preset N1 value with the gear up.

6. **How is the landing gear locked in the up position?** (AFM)

Hydraulic system pressure performs the uplock function and holds the gear in the UP position.

7. **The upward travel of the landing gear is stopped when what condition is satisfied?** (AFM)

When a hydraulic pressure of 2,775 psi is obtained, a pressure switch removes power to the hydraulic pump motor.

8. **What would cause the landing gear motor to cycle in flight?** (AFM)

When hydraulic system pressure drops below 2,320 psi.

9. How is manual extension of the gear accomplished? (AFM)

An alternate extension handle is provided (located on the floor to the right of the captain's seat) which uses hydraulic fluid from a secondary reservoir directed to the extend side of the hydraulic actuators. Remove the alternate extension handle from clip, and begin to pump. Continue to pump until three green "gear down" indicator lights are illuminated. This procedure requires approximately 80 strokes to extend and lock the gear. *Note:* Gear handle must be down, landing gear relay circuit breaker must be pulled, and airspeed must be less than 180 knots.

10. How is nosewheel steering accomplished? (AFM)

A mechanical linkage connected to the rudder pedals is provided. The steering system is disconnected from the rudder control system when the airplane becomes airborne. A power steering system may also be installed, consisting of an electric motor that drives a hydraulic pump, a hydraulic actuator, and a servo valve assembly.

F. Engines

1. What type of engines are installed on the BE-1900? (AFM)

Pratt & Whitney PT6A-65B, reverse airflow, free turbine, turboprop engines.

2. **The engine contains how many drive shafts?** (AFM)

   Two; one compressor (gas generator) shaft and one power turbine shaft.

3. **How many and what type of compressor stages are used in this engine?** (AFM)

   Four axial-flow stages and one centrifugal-flow stage.

4. **What type of combustion chamber is used?** (AFM)

   Annular

5. **What types of power and compressor turbines are used on this engine?** (AFM)

   Power turbine — two stage axial flow reaction turbine

   Compressor (gas generator) turbine — single stage axial flow reaction turbine

6. **What is the engine shaft horsepower rating?** (AFM)

   1,100 SHP

7. **What is the compressor (gas generator) shaft rotational speed (N1) limits for the following operating conditions: Takeoff, Maximum Continuous, Cruise Climb, Maximum Cruise and Transient?** (AFM)

   104% N1 (39,000 rpm)

8. **What is the approximate gear reduction ratio between the power turbine and the propeller?** (AFM)

   17.6 to 1

9. What are some of the items located on the engine accessory gearbox? (AFM)

Starter/generator, engine oil pump, N1 tachometer generator, low- and high-pressure fuel boost pumps, fuel control unit.

10. Describe the engine lubrication system. (AFM)

An integral tank between the engine air intake and the accessory case contains oil used to cool as well as lubricate the engine. Engine oil temperature is maintained within operational limits by an engine oil radiator located inside the lower nacelle.

11. What condition will cause the L/R OIL PRESS annunciator to illuminate in flight? (AFM)

Oil pressure has dropped below 60 psi.

12. What is the function of the "auto ignition" switches? (AFM)

When selected to ON, they provide automatic ignition to prevent engine loss due to combustion failure. Normally used during takeoff and landing as well as when operating in turbulence, icing, and heavy precipitation conditions.

13. Describe the propulsion system controls for this airplane. (AFM)

Three sets of controls are provided:

a. *Power levers*— control engine power.

b. *Condition levers*— control idle cutoff function of the fuel control unit; limits idle speed to 58% N1 for low idle, or 72% for high idle. Three positions: FUEL CUTOFF, LOW IDLE and HIGH IDLE.

c. *Propeller levers*— control constant speed propellers through a primary governor.

14. Describe how the power levers operate. (AFM)

The power levers control engine power by operation of the gas generator (N1) governor in the fuel control unit. An increase in N1 rpm causes an increase in engine power.

15. What type of engine instrumentation is provided? (AFM)

a. *ITT indicators*— indicate engine gas temperature between compressor and power turbines.

b. *Torque meters*— indicate foot-pounds of torque applied to propeller.

c. *Propeller tachometers (N2 speed)*— indicate prop rpm.

d. *Gas generator (N1) tachometers*— indicate rotational speed of compressor shaft in percent of rpm based on 37,468 rpm at 100%.

e. *Fuel flow gauges*— indicate fuel flow in pounds per hour times 100.

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f. *Combination oil temperature/pressure gauges*—pressure on the right side and temperature on the left.

G. Fire Detection

1. Describe the fire detection system. (AFM)

Composed of the following:

a. Two fire zone cables installed in each nacelle interconnected to form a continuous loop.

b. A single control amplifier in flight compartment on forward bulkhead.

c. A control circuit breaker placarded FIRE DET.

d. Two toggle test switches on co-pilot's inboard subpanel.

2. What is the function of the fire cable and control amplifier? (AFM)

Heat sensitive cables are looped around the engines so as to monitor the most likely areas for fires to occur. If a fire were to occur, heating of the cable causes resistance to drop. The control amplifier will sense this drop and at a preset level, illuminate the red light in FIRE PULL "T" handle.

3. How is fire extinguishing accomplished in this aircraft? (AFM)

a. Pull the FIRE PULL “T” handle for the appropriate engine which will cause the system to arm.

b. Raise the safety-wired clear plastic cover and press face of lens, which causes pyrotechnic cartridge to discharge. One pyrotechnic cartridge in each main gear wheel well.

c. When fully discharged, yellow D light will illuminate.

4. How is the fire detection/extinguishing system tested? (AFM)

Two toggle-type test switches placarded ENG FIRE TEST—EXT TEST, one for the left system and one for the right system are provided. The switches test the circuitry of the fire extinguisher pyrotechnic cartridges. A successful test is indicated by illumination of a yellow “D” light and the illumination of a green “OK” light on each fire extinguisher switch on the glareshield.

H. Propeller

1. Describe the propeller system. (AFM)

Conventional four-blade, composite, constant-speed, full-feathering, reversing, counter-weighted, variable-pitch propeller. The propeller is mounted on the reduction gearbox output shaft. Single-action, engine-driven propeller governors use engine oil pressure to control propeller pitch and speed. Engine oil pressure moves the propeller to high rpm (low-pitch) hydraulic stop and reverse positions. Centrifugal counterweights, assisted by a feathering spring, move the propeller blades to low rpm (high-pitch) and into the feathered position.

2. Describe how the propeller levers operate. (AFM)

Movement of the propeller lever positions a pilot valve that allows oil to be directed to or from the propeller hub, which results in an increase or decrease in propeller rpm. To feather a propeller, the propeller lever lifts a pilot valve to a position causing a complete dumping of high-pressure oil. This allows counterweights and feathering spring to change prop pitch. The propeller control levers range of operation is 1,400 to 1,700 rpm.

3. What is "propeller ground fine" position used for? (AFM)

Used to provide maximum deceleration on the ground during landing. Takes advantage of max available propeller drag.

4. **What controls the propeller blade angle while on the ground and in "ground fine"?** (AFM)

   The condition levers.

5. **How is propeller reversing accomplished?** (AFM)

   Lift power levers past IDLE and GND FINE position. Power levers are now controlling engine power through the reverse range.

6. **What is the function of the propeller low pitch stop?** (AFM)

   The low pitch stop prevents the propeller from reversing in flight.

7. **Describe the function of the propeller synchrophaser, synchronizer and synchroscope.** (AFM)

   a. *Synchrophaser*— positions propellers at a preset phase relationship which assists in decreasing cabin noise. First adjust prop levers or synchronization, then switch on.

   b. *Synchronizer*— matches the rpm of the slower propeller to the faster propeller.

   c. *Synchroscope*— instrument in the cockpit used to display difference in rpm between propellers. The gage consists of a small propeller that rotates in the direction of the higher rpm propeller.

8. What are the three types of propeller governors and what is their function? (AFM)

a. *Primary (constant speed) governor*—mounted on the reduction gear housing, controls the propeller throughout its normal operating range. The primary governor has authority within the 1,400 to 1,700 rpm range.

b. *Fuel topping*—prevents the power turbine from overspeeding by reducing the amount of fuel to the fuel control unit.

c. *Overspeed governor*—in the event of a constant-speed governor malfunction (requesting more than 1,700 rpm) the overspeed governor activates at 1,768 rpm and dumps oil pressure from the propeller to keep rpm from exceeding approximately 1,768 rpm.

9. How do the propeller governors control rpm? (AFM)

They utilize engine oil pressure.

10. What happens to propeller blade angle as oil enters the propeller hub? Leaves the hub? (AFM)

As oil enters, it causes the propeller blade angle to decrease. As it leaves the hub, the propeller blade angle will increase.

11. If a propeller overspeed occurs, what does this indicate? (AFM)

A failure of the primary governor has occurred.

12. How does the autofeather system work and when must it be armed? (AFM)

In the event of an engine failure, the autofeather system automatically dumps oil from the propeller servo, which enables the feathering spring and counterweights to start the feathering action of the blades. The autofeather system must be armed for takeoff, climb, approach and landing.

13. When does the autofeather system arm? (AFM)

a. Autofeather switch is in the ARM position.

b. Both power levers are greater than 88 to 91 percent N1.

c. Torque is greater than 525 feet-pounds.

14. With the autofeather system armed, what will happen in the event of an engine failure? (AFM)

When torque is less than 320 foot-pounds, the system will feather the propeller.

I. Fuel System

1. Describe the fuel tank system. (AFM)

a. Two integral fuel tanks in each wing.

b. Main tank extends from the nacelle to the wingtip; 241.3 gallons usable; filled from a port located near wing tip.

c. Collector tank (located inside each main tank) is supplied fuel from the main tank by gravity feed and two jet transfer pumps. Ensures a constant fuel level in collector tank at normal flight attitudes.

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d. Auxiliary tank is located between fuselage and nacelle; 92.3 gallons usable; filled from a port located inboard of nacelle.

2. What are the different types of fuel pumps? (AFM)

a. *Engine-driven fuel pump*— high-pressure, mounted on accessory case along with fuel control unit.

b. *Engine-driven primary boost pump*— low-pressure, mounted on drive pad at aft accessory section.

c. *Electrically-driven standby pump*— low pressure, located in bottom of collector tank sump. Serves as backup for engine driven pump; also provides cross-transfer fuel flow.

d. *Electrically-driven auxiliary fuel pumps*— transfer fuel to the collector tank in same wing.

3. What will happen in the event of an engine-driven pump failure? (AFM)

Failure of the engine-driven, high-pressure fuel pump will result in an immediate engine flame-out.

4. Where are the fuel drains located? (AFM)

Six drains in each wing:

- One drain for auxiliary tank located underside of wing inboard of nacelle.
- Two drains for collector tank located outboard side of nacelle.
- Two drains for main tank located underside of wing, outboard of nacelle.
- One drain for fuel filter located underside of wing outboard of nacelle.

5. How is fuel system venting accomplished? (AFM)

Both the main and auxiliary fuel systems are vented through a recessed ram vent coupled to a protruding ram vent on the underside of wing tip. Recessed vent is ice resistant by design; protruding vent is heated to prevent icing.

6. Describe the operation of the fuel purge system. (AFM)

The system uses a small purge tank pressurized by the engine compressor (P3) discharge air. On engine shutdown, the purge tank pressure forces excess fuel out of the engine fuel manifold lines, through the fuel nozzles and into the engine, where the fuel is burned. Usually results in a momentary surge in N1 gas generator rpm.

7. Describe the fuel quantity indicators. (AFM)

a. Capacitance type fuel quantity indication system.

b. Fuel quantity indicators (left and right) indicate fuel (in pounds) remaining in respective fuel tanks.

c. Compensates for changes in fuel density due to temperature changes.

d. Maximum indication error of 3% full scale.

e. Fuel quantity in auxiliary tanks determined by deflecting a spring-loaded fuel quantity switch to "Aux." position.

8. How is fuel transferred from the fuel tanks to the engines? (AFM)

Engine-driven fuel pumps (high-pressure and boost) draw fuel from the collector tank. The collector tank draws fuel from its respective main tank (unless fuel is being supplied from the auxiliary tank). Auxiliary tank fuel should be used prior to using fuel in the main tanks. Accomplished by positioning auxiliary pump switches to AUTO. When no fuel is remaining in auxiliary tank, the pump automatically shuts off.

9. Proper fuel management in this aircraft requires fuel from the auxiliary tanks to be used before the main tank fuel. Why? (AFM)

In the event of an auxiliary pump failure, the fuel remaining in the auxiliary tanks would not be available for flight. Backup or secondary pumps are not installed and it is not possible to gravity feed fuel from the auxiliary fuel tanks.

10. Describe how you would cross-transfer fuel from one tank to another. (AFM)

a. Standby pump switches in OFF position.

b. Move lever lock switch (TRANSFER FLOW -OFF) from the center OFF position to the left or right, depending on direction of flow.

c. Cross-transfer valve is now open which energizes standby pump on the side from which cross-feed is desired. Green FUEL TRANSFER annunciator on caution/advisory panel will illuminate.

11. How do the firewall shutoff valves work? (AFM)

Two firewall shutoff valves are provided, one for each engine. The valves are controlled by the FIRE PULL handles located on the upper center instrument panel. When the FIRE PULL handle is pulled, it closes the firewall shutoff valve and arms the fire extinguisher.

12. How does the fuel control unit work? (AFM)

The fuel control unit regulates fuel flow to the engine by metering fuel to the fuel nozzles. It compares power and condition lever position to the selected N1 (gas generator speed).

13. How is fuel system icing prevented? (AFM)

Via an oil-to-fuel heat exchanger, located on the engine accessory case which operates continuously.

J. Electrical System

1. Describe the electrical system. (AFM)

a. Negatively-grounded 28-volt DC system (grounded to aircraft structure).

b. 23 amp/hour NiCad battery, or optional 34 amp/hour air-cooled NiCad battery.

c. Two 28-volt, 300 amp starter/generators supply all power to DC buses and the battery (to maintain charge).

d. AC power is provided by two 115/26 VAC, 400 Hz inverters.

2. Where is the battery located? (AFM)

It is located in the right wing root between the fuselage and the right engine nacelle.

3. What volts/amps are required for starting when using an external power cart? (AFM)

External power carts should be capable of providing 28.0–28.4 volts, and a minimum of 1,000 amps momentarily and 300 amps continuously.

4. The electrical system consists of several buses. What are they? (AFM)

Two generator buses, two center buses, a battery bus, and a triple-fed bus are provided.

5. Describe how electrical power is distributed among the various buses. (AFM)

The electrical system uses the triple-fed bus arrangement, which means that most electrical system buses receive power from three power sources. Each individual bus is powered by its respective source — the battery, the left generator, and the right generator. In normal operation, all buses are automatically tied into a single loop. A hot battery bus provides power for essential equipment such as cockpit emergency lighting, threshold lighting, fire extinguishing system and the main entry door.

6. What other equipment is located on the hot battery bus? (AFM)

Left and right firewall fuel shut-off valves, external power annunciator, forward baggage door annunciator, control wheel clock, pitot heater right side, ground communication power.

7. Describe the function of the main starter/generators. (AFM)

The starter/generators act as starters for the engines up to 52% N1. Above that value, they assume the function of a generator producing 28 volts/300 amps to power the aircraft electrical buses.

8. How is generator output monitored? (AFM)

Two volt/loadmeters are provided to monitor generator output and battery charge.

9. What are the functions of the two generator control units (GCU)? (AFM)

a. Voltage regulation (28.25 ±.25 volts).
b. Line contactor control (connection of generators to electrical buses).
c. Overvoltage protection (over 32 volts).
d. Load sharing and paralleling (within 10%).
e. Reverse current protection.
f. Cross start current limiting.

10. Three high-current-sensing devices control three bus tie relays. What is their function? (AFM)

Also known as HEDs (hall effect devices), these sensors actuate by opening the affected bus tie anytime they sense a current of 275 amps or higher supplied from a single source. They effectively isolate the bus requiring the high current and allow the remaining power sources to continue functioning as a system.

11. What is the function of a line contactor relay? (AFM)

Line contactor relays connect power from the generators to the electrical system buses. They are also used as reverse-current devices by the generator control units. The relays prevent the generators from absorbing power from the bus when the generator voltage is less than the bus voltage.

K. Environmental

1. Describe the pressurization system on this aircraft. (AFM)

The pressurization system uses bleed air from the compressor section of each engine to pressurize the cabin. The system provides a pressure differential of 4.8 ± .1 psi. The bleed air is precooled by a heat exchanger and two valves before it enters the air cycle machine (ACM), or bypasses the ACM and is ducted to the cabin. Bleed air flow and pressure are controlled from the cockpit by the environmental bleed air shutoff valves.

2. What is the function of the pressurization controller? (AFM)

The adjustable pressurization controller commands modulation of the outflow valve. The controller has an inner and outer scale. The outer scale indicates cabin pressure altitude that the controller will

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maintain (set by the pilot). The inner scale indicates the maximum ambient pressure altitude the airplane can fly without causing the cabin pressure altitude to exceed the value set on the outer scale.

3. What is the function of the outflow valves? (AFM)

a. Control cabin pressure by venting excess air overboard.

b. Provide both positive and negative pressure relief.

c. Provide a means of "dumping" the cabin pressure.

4. How is pressurization of the aircraft indicated in the cockpit? (AFM)

The actual cabin pressure altitude is indicated by a cabin altimeter, mounted on the forward panel between caution/annunciator panel and pedestal. A cabin vertical speed indicator is also provided which indicates the rate at which cabin pressure altitude is changing; it is located immediately to the left of the cabin altimeter.

5. What is the function of the cabin pressure switch? (AFM)

The cabin pressure switch allows the pilot to pressurize the aircraft, depressurize the aircraft or test the system. A three-position switch labeled DUMP, PRESS, and TEST controls the system. The DUMP position holds the outflow valves open and depressurizes the cabin. The PRESS position allows the outflow valves to be controlled by the pressurization controller. The TEST position opens the landing gear safety switch circuit, allowing the outflow valves to close. This feature allows the aircraft to be pressurized on the ground. The switch is located forward of the pressurization controller on the pedestal.

6. Describe the operation of the pressurization system. (AFM)

a. Prior to takeoff, adjust the cabin altitude selector knob so that 1,000 feet above planned cruise pressure altitude is displayed on indicator.

b. Ensure that the CAB ALT scale indicates an altitude of at least 500 feet above takeoff field pressure altitude.

c. Adjust rate controller knob as desired (setting index mark at 12 o'clock position results in 500-fpm cabin rate of climb; most comfortable).

d. Ensure that cabin pressure switch is in PRESS position.

e. The cabin pressure altitude will climb at the selected rate and once established at the pre-selected pressure altitude, the system will maintain that selected altitude.

7. **Describe how the pressurization system reacts to a change in altitude.** (AFM)

   If the altitude selected on the ACFT ALT scale is not adjusted, and the aircraft climbs, cabin-to-ambient pressure differential will reach the pressure relief setting of the outflow valves. The outflow valves will override the pressurization controller in order to maintain cabin pressure differential to 4.8 psi ± .1 psi.

8. **What mechanism is used to prevent the aircraft from being pressurized on the ground?** (AFM)

   When the aircraft is on the ground, the landing gear safety switch on the left gear signals the outflow valves to modulate to the full open position.

9. **How does the altitude warning feature work?** (AFM)

   A pressure-sensing switch, located on the electrical panel of the forward aft bulkhead, will close anytime it senses a cabin pressure altitude of 12,500 feet resulting in illumination of the CABIN ALTITUDE annunciator.

10. **What will happen if both bleed air valves are positioned to INST and ENVIR OFF?** (AFM)

    Loss of pressurization will occur. No bleed air is being supplied to the pressure vessel.

11. How can the pilot ventilate the aircraft if it is unpressurized? (AFM)

A manually-controlled valve, located in the nose ram air duct, can be opened to supply ambient air to the cabin when the airplane is not pressurized. Air enters the airplane through the ram air door solenoid valve and the manual valve when the cabin pressure control switch is set to "dump."

12. How is the aircraft heated? (AFM)

Engine bleed air is used to heat the cabin. The bleed air enters the cabin distribution ducts for heating through the air cycle machine and ejector bypass valves. When heating is required, the air cycle machine bypass valve opens and modulates output of the ACM. When maximum heating is required, the ACM bypass valve modulates to the full open position and then directs current to the ejector bypass valve, which also modulates to the full open position. The heated air is ducted to outlets in the cabin sidewalls, crew vents and defroster.

13. How is the aircraft cooled? (AFM)

Both an air cycle system and a vapor cycle system are used to provide cabin cooling. When the air cycle system is providing maximum cooling, a signal is automatically generated by the temperature control circuitry resulting in the vapor cycle system coming online to provide further cooling. For maximum cooling, both the ejector bypass valve and the ACM bypass valves are closed and the VCM is online.

14. Describe the air cycle system. (AFM)

Air cycle machines use engine bleed air to turn a compressor that compresses air, resulting in a rise in temperature. The high-temperature air is routed through heat exchangers to remove some of the excess heat, then sent to the ACM expansion turbine. As the air passes through the turbine, it rotates the turbine and the impeller. After the compressed air performs the work of turning the turbine, it undergoes a pressure and temperature drop resulting in an air temperature significantly lower than the ambient air temperature.

15. Describe the vapor cycle system. (AFM)

The vapor cycle system consists of the following:

a. *Compressor*— increases pressure of refrigerated gas when it is in vapor form. Provides force necessary to circulate gas through the system.

b. *Condensing coil and blower assembly*— removes heat from compressed high-pressure, high-temperature refrigerated gas coming from the compressor. Changes state from gas to liquid.

c. *Thermostatic expansion valve*— metering device that directs high-pressure, low-temperature refrigerated liquid to the evaporator.

d. *Evaporator*— lowers pressure of refrigerated liquid causing a change in state from liquid to gas; results in maximum cooling.

e. *Evaporator coil*— air is routed over coil where heat is removed before being returned to the cabin.

f. Low-pressure, low-temperature refrigerant is then returned to the compressor.

16. **What conditions must be met in order for the VCM to operate?** (AFM)

Outside air temperature of greater than 45°F, ACM bypass valve fully closed, and the right engine is operating at 62% N1.

L. Oxygen

1. **Describe the oxygen system on this aircraft.** (AFM)

   a. Consists of two 76.6 foot cylinders.

   b. Mounted under the floor of the nose baggage compartment.

   c. Two cylinder pressure gauges on copilot right subpanel.

   d. Pressure gage indicating pressure to the cabin masks right side of instrument panel.

2. **What is the system pressure for the oxygen system?** (AFM)

   1,850 psi at 70°F.

3. Describe the oxygen system for the crew. (AFM)

a. Constant-flow type (O_2 flows continuously).

b. Cylinder-mounted constant-flow regulators with reduced pressure output.

c. Two oxygen outlets and associated masks located behind the overhead light control panel.

d. Removal/insertion of a lanyard pin controls oxygen flow to the masks.

4. How are the two oxygen cylinders actuated? (AFM)

A push pull control knob labeled OXYGEN — PULL ON, simultaneously actuates the two oxygen cylinders.

5. Describe the passenger oxygen masks. (AFM)

a. Constant-flow type (O_2 flows continuously).

b. Altitude compensating.

c. Constant-flow regulator varies flow rate to masks based on altitude (mounted on left side of airplane, aft of forward pressure bulkhead).

6. **How is oxygen flow to the passenger masks initiated?** (AFM)

   A push-pull control knob labeled CABIN OXYGEN — PULL ON, governs the flow of oxygen to the passenger oxygen outlets. The passenger must remove a lanyard valve pin from the mask to start the flow of oxygen.

7. **What mechanism causes the passenger mask container door to open?** (AFM)

   When the push-pull control knob is pulled out, a surge valve will initially allow high pressure to reach the mask container door, causing the door to open and allowing access to the mask.

M. Pitot Static System

1. **Describe the pitot-static system on this airplane.** (AFM)

   a. Two pitot tubes (pilot and copilot).

   b. Two separate sources of normal static air; one for pilot and one for copilot.

   c. Normal static air provided by static ports located on the pitot/static masts.

   d. Alternate static source is provided; alternate line obtains static air from each side of the lower nose.

2. Are the static lines interconnected? (AFM)

Yes; the two static sources are connected together so that, in the event of one source becoming obstructed, both pilot and copilot instruments will still be functional from the remaining source.

3. In the event of a failure of either pilot's normal static air source, what procedure should be followed? (AFM)

The alternate static source should be selected by lifting a spring-clip retainer off the pilot or copilot's static air source valve switch, and then moving that switch to the ALTERNATE position.
Note: When using an alternate static air source, the altimeter, airspeed and vertical speed instrument indications will be affected.

N. Engine Bleed Air Pneumatic System

1. What are some of the aircraft systems that utilize engine bleed air? (AFM)

Cabin pressurization, heating and cooling, brake deice, deice boots, hydraulic system, vacuum system.

2. Bleed air is obtained from which engine stage? (AFM)

P3

3. What is the approximate temperature of bleed air? (AFM)

800°F. Precooled to 450°F before use by the environmental system (pressurization/air conditioning).

4. Describe the bleed air warning system. (AFM)

EVA tubing (plastic) pressurized to 18 psi is co-located with the bleed air ducting running from the engines to the cabin. Any excessive heat caused by a bleed air duct rupture would cause the EVA tubing to melt resulting in an immediate drop in pressure. The drop in pressure causes a switch in the line to close illuminating the L or R BL AIR FAIL annunciator in the warning annunciator panel.

5. What is the function of the bleed air valve switches? (AFM)

In the event of a bleed-air line failure, bleed air for that particular line may be shut off by positioning the BLEED AIR VALVE switch on the FO's left subpanel in the INSTR and ENVIR OFF position.

6. What is normal pneumatic system pressure regulated at? (AFM)

18 psi

7. How is pneumatic pressure used to create vacuum for the vacuum system? (AFM)

Vacuum is created by directing pneumatic air through a bleed air ejector.

8. What aircraft systems use vacuum for operation? (AFM)

a. Aircraft flight instruments (directional gyro and attitude indicator).

b. Surface deice system (deflates deice boots).

c. Pressurization system (outflow valves, pressurization controller).

9. What is the vacuum system pressure regulated at? (AFM)

4.3" to 5.9" Hg

O. Ice Protection

1. What are the two basic types of ice protection equipment? (AFM)

Anti-ice and deice.

2. What are some of the anti-ice systems on this airplane? (AFM)

Engine air inlet lip heat, inertial separators, pitot heat, static port heat, windshield heat, stall warning vane heat, fuel vent heat, oil-to-fuel heat exchanger.

3. What are some of the deice systems on this airplane? (AFM)

Brake deice, surface deice (boots), propeller deice.

4. What effect does placing the windshield anti-ice switch in the NORM and HI positions have? (AFM)

NORM — A major portion of the windshield is supplied with heat.

HI — A higher level of heat is supplied to a smaller area of the windshield.

5. Describe the propeller electric deice system. (AFM)

a. Electrically-heated deice boots
b. Slip rings and brush block assemblies
c. Timer for automatic operation
d. Dual-scale ammeter
e. Two prop deice control circuit breakers
f. Circuit breakers and current limiters for protection of prop deice boot wiring
g. Two switches for auto or manual control of system

6. Describe the operational sequence of the propeller deice system when the switch is in the AUTO position. (AFM)

When the switch placarded PROP-AUTO is selected to AUTO, the propeller automatic timer supplies power to the heating elements of one propeller for 90 seconds. Then it automatically switches over to supply power to the other propeller for 90 seconds. Each cycle takes approximately 3 minutes.

7. Describe the operational sequence of the propeller deice system when the switch is held in the MANUAL position. (AFM)

When the switch placarded PROP-MANUAL is held in the MANUAL position, the heating elements on both of the propellers are supplied power. The switch should be held in the MANUAL position for approximately 90 seconds.

8. How is normal operation of the propeller deice system be verified in the cockpit? (AFM)

With the propeller deice switch in the ON position, normal operation of the propeller deice system can be accomplished by monitoring normal current flow to each propeller blade of 26 to 32 amps on a dual-scale ammeter located on the overhead panel.

9. What type of ice protection is provided for the engines? (AFM)

a. *Engine air inlet*— engine exhaust is used for heating air inlet lips. The hot exhaust is collected by a scoop and ducted downward to connect with inlet lip.

b. *Engine anti-ice*— inertial separation system is provided in each engine air duct; prevents moisture from entering the engine inlet plenum during icing conditions.

10. What aerodynamic surfaces are protected by the surface deice system? (AFM)

The leading edges of the wings, stabilons, and horizontal stabilizers.

11. Describe the operation of the surface deice system. (AFM)

Pressure-regulated engine bleed air supplies the necessary pressure to inflate the boots. The vacuum needed to hold the boots in the deflated position is created by bleed air directed through a venturi ejector. A distributor valve controls the inflation and deflation cycles.

12. Describe the sequence of deice boot inflation when the surface deice switch is in the SINGLE position. (AFM)

a. Distributor valve opens to send bleed air to outboard wing boots for 6 seconds.

b. Electronic timer switches distributor to deflate outboard boots.

c. Electronic timer opens distributor to inflate inboard wing boots, horizontal stabilizer and stabilon boots for 6 seconds then deflates. Cycle is now complete.

13. Describe the sequence of deice boot inflation when the surface deice switch is held in the MANUAL position. (AFM)

All the boots will inflate simultaneously and remain that way until the switch is returned to the OFF position.

14. When must the auto ignition system be armed? (AFM)

During takeoff, landing, turbulence, and anytime the aircraft is being operated in icing conditions or heavy precipitation. Also used for takeoffs from contaminated runways. Prevents engine loss due to combustion failure (engine flame out).

BE-1900 Limitations

Airline Transport Pilot Oral Exam Guide—BE-1900 Systems
by Michael D. Hayes

The following questions are in reference to the Beechcraft 1900-C limitations.

These questions are representative of what you are required to know about your aircraft limitations. Review your aircraft's AFM for answers specific to the airplane your checkride will take place in.

The blank lines can be used to document the information for aircraft you will be flying or testing in other than the BE-1900.

A. Airspeed Limitations

1. **What is V_A?** (AFM)

   V_A (16,600) 188 KIAS ____________________

2. **What is V_{FE} at the takeoff position (10% flap deflection)?** (AFM)

   198 KIAS ____________________

3. **What is V_{FE} at the approach position (40% flap deflection)?** (AFM)

   168 KIAS ____________________

4. **What is V_{FE} at the down position (100% flap deflection)?** (AFM)

   153 KIAS ____________________

5. **What is V_{LO}?** (AFM)

   Extension—180 KIAS ____________________

   Retraction—180 KIAS ____________________

6. **What is V_{LE}?** (AFM)

   180 KIAS ____________________

7. **What is V_{MO}/M_{MO}?** (AFM)

   V_{MO}—247 KIAS ____________________

   M_{MO}—.48 Mach ____________________

8. What is V_{MCA}? (AFM)

Flaps up.. 96 KIAS

Takeoff flaps .... 91 KIAS

Approach flaps................................ 89 KIAS

9. What is the maximum demonstrated crosswind component? (AFM)

22 knots

10. What is the two-engine best angle-of-climb (V_X) speed? (AFM)

122 knots

11. What is the two-engine best rate-of-climb (V_Y) speed? (AFM)

138 knots (decrease 2 knots per 5,000 feet)

12. What airspeed should be used for cruise climb airspeed? (AFM)

Sea level to 10,000 feet.................. 160 knots

10,000 to 15,000 feet .... 150 knots

15,000 to 20,000 feet .... 140 knots

20,000 to 25,000 feet .... 130 knots

13. What is the recommended turbulent air penetration airspeed? (AFM)

170 knots

14. What is the minimum speed for operations in icing conditions? (AFM)

160 KIAS

15. What is the minimum airspeed to air-start the engine without using starter assist? (AFM)

140 KIAS ______________________

16. What is the maximum windshield anti-icing speed? (AFM)

223 KIAS ______________________

B. Emergency Airspeeds (at 16,600 pounds)

1. What is the one-engine-inoperative best angle-of-climb (V_{XSE}) airspeed? (AFM)

120 knots ______________________

2. What is the one-engine-inoperative best rate-of-climb (V_{YSE}) airspeed? (AFM)

125 knots ______________________

3. What is the one-engine-inoperative best enroute climb (V_{ENR}) airspeed? (AFM)

125 knots ______________________

4. What are the minimum control airspeeds (V_{MCA}) airspeeds? (AFM)

Flaps up.. 96 knots ______________

Flaps takeoff.................................. 91 knots ______________

Flaps approach............................... 89 knots ______________

5. What airspeed should be used in an emergency descent? (AFM)

180 knots ______________________

6. What airspeed should be used for a maximum-range glide? (AFM)

125 knots ______________________

C. Powerplant Limitations

1. **What is the maximum ITT for start?** (AFM)

   1,000°C

2. **What is the maximum allowable ITT for takeoff?** (AFM)

   820°C limited to 5 minutes

3. **What is the maximum continuous torque?** (AFM)

   3,400 foot-pounds

4. **What is the maximum allowable transient torque?** (AFM)

   5,000 foot-pounds for 20 seconds

5. **In the event that a starter-assisted air-start must be performed, engine ITT must be reduced to what value?** (AFM)

   700°C or below

6. **What is the maximum propeller overspeed limit?** (AFM)

   1,870 for 20 seconds

7. **What is the maximum rpm for takeoff?** (AFM)

   1,700 rpm

8. **What is the maximum propeller rpm?** (AFM)

   1,870 rpm

9. **What is maximum reverse propeller rpm?** (AFM)

   1,650 rpm

10. **When should an aborted start be performed?** (AFM)

    If no rise in ITT occurs within 10 seconds after introducing fuel.

11. What is the minimum oil pressure at flight idle? (AFM)

60 psi

12. What are the minimum and maximum N1 values? (AFM)

58% and 104%

13. What are the compressor (gas generator) shaft rotational speed (N1) limits? (AFM)

At takeoff/maximum continuous/cruise climb/maximum cruise power, 104.0% N1 (39,000 rpm).

14. What is the oil quantity for this engine? (AFM)

System capacity is 15.6 quarts or 3.9 gallons. Oil quantity range is MAX to 4 QUARTS LOW on dipstick.

15. What is the maximum outside operating air temperature? (AFM)

ISA plus 37°C

16. What are oil temperature limitations? (AFM)

-40°C to +99°C; 110°C for up to 10 minutes.

17. The autofeather mechanism is disabled at what engine setting? (AFM)

550 foot-pounds

18. While in cruise flight, what oil pressure would require engine shut down? (AFM)

Below 60 psi

19. What are the minimum and maximum oil temperature limits? (AFM)

-40°C to +99°C; a maximum temperature of +110°C for no more than 10 minutes.

20. What is the minimum recommended oil temperature for fuel heater operation at takeoff power? (AFM)

+55°C

21. While in cruise flight, what oil pressure would require engine shut down? (AFM)

Below 60 psi

D. Electrical System

1. What is the maximum differential between generator loadmeters? (AFM)

10%

2. What is the minimum voltage for battery start? (AFM)

23 VDC

3. What is the maximum generator load during ground operations? (AFM)

100% with air conditioning off

4. At what N1 value will the starter/generators "start" function stop and "generator" function begin? (AFM)

At or above 52% N1

5. What are the starter operating limitations? (AFM)

30 seconds ON

3 minutes OFF

30 seconds ON

30 minutes OFF

6. **What are the generator limitations?** (AFM)

0 to 50% generator load—air conditioning ON 65% N1
air conditioning OFF...58% N1

50 to 75% generator load—air conditioning ON.................70% N1
air conditioning OFF...60% N1

75 to 100% generator load—air conditioning ON...............72% N1
air conditioning OFF...72% N1

7. **What is the required power output of an external power cart used for engine starting?** (AFM)

28.0–28.4 volts and 1,000 amps momentarily and 300 amps continuously.

8. **What is the required power output of an external power cart used for engine starting?** (AFM)

28.0–28.4 volts and 1,000 amps momentarily and 300 amps continuously.

9. **Where is the external power supply receptacle located?** (AFM)

Under the aft portion of the left nacelle.

E. Fuel System

1. **What is the usable capacity of the main tanks at 6.64 density?** (AFM)

241.3 gallons/1,626.5 pounds

2. **What is the usable capacity of the auxiliary fuel tanks?** (AFM)

92.3 galllons/622 pounds

3. **What is the maximum useable fuel quantity?** (AFM)

667.2 gallons/4,497 pounds ______________________

4. **What is the maximum usable fuel quantity in each wing tank?** (AFM)

333.6 gallons/2,248.5 pounds ______________________

5. **What minimum fuel is required for takeoff?** (AFM)

363 lbs in each wing system; do not take off if fuel quantity gauges are in the yellow arc. ______________________

6. **What are the approved engine fuels available for use in this engine?** (AFM)

Commercial—Jet A, Jet A-1, Jet B ______________________

Military—JP-4, JP-5, JP-8 ______________________

7. **Is it possible to use AVGAS in this engine, in the event approved fuels are unavailable?** (AFM)

Yes; operation is limited to no more than 150 hours between engine overhauls. Flight altitude is limited to below 15,000 feet.

____

____

8. **What is the minimum fuel pressure?** (AFM)

100 psi ______________________

9. **How many fuel drains are located on each wing?** (AFM)

6 ______________________

10. **What is the engine-driven fuel pump pressure?** (AFM)

850 psi ______________________

11. **What is the output pressure of the standby pump?** (AFM)

30 – 45 psi ______________________

12. What is the engine-driven boost pump pressure? (AFM)

45 psi ____________________

13. What is the minimum fuel temperature for Jet A? (AFM)

-40°C ____________________

14. What is the maximum demonstrated imbalance between left and right fuel tanks? (AFM)

200 pounds ____________________

F. Weight and CG Limitations

1. What is the maximum ramp weight? (AFM)

16,710 pounds ____________________

2. What is the maximum takeoff weight? (AFM)

16,600 pounds ____________________

3. What is the maximum landing weight? (AFM)

16,100 pounds ____________________

4. What is maximum zero fuel weight? (AFM)

14,000 pounds ____________________

5. What is the maximum weight in the baggage compartments? (AFM)

Nose—150 pounds __________

Forward cabin compartment—250 pound __________

Hangar, Forward Cabin Compartment—100 pounds __________

Aft baggage compartment (fwd section)—880 pounds __________

Aft baggage compartment (aft section)—630 pounds __________

6. **What are the load factor maneuvering limitations?** (AFM)

Takeoff flaps and flaps up—3.00 positive Gs; 1.20 negative Gs

Flaps approach and landing—2.00 positive Gs; 0.00 negative Gs

7. **What is the maximum cabin floor loading?** (AFM)

100 lbs/sq. ft.

8. **What are the aft and forward CG limits in inches aft of datum?** (AFM)

Aft limit: 299.9 inches aft of datum for all weights.

Forward limit: 282.2 inches aft of datum at 16,600 pounds to 274.5 inches aft of datum at 11,600 pounds.

9. **Where is the reference datum located?** (AFM)

83.5 inches forward of the center of the front jack point.

G. Other Limitations

1. **What category is the BE-1900 certified under?** (AFM)

Normal

2. **Where are the emergency exits located?** (AFM)

The main cabin door and 3 overwing exits are provided.

3. **What are the outside air temperature limitations?** (AFM)

ISA plus 37°C for operations from sea level to 25,000 feet pressure altitude.

4. **What is the minimum flight crew for the BE-1900?** (AFM)

   One pilot

5. **What is the maximum passenger occupancy limitation?** (AFM)

   Nineteen

6. **What are the normal and maximum pressure differentials?** (AFM)

   Normal—4.8 psid

   Maximum—4.9 psid

7. **What is the maximum cabin altitude?** (AFM)

   12,500 feet

8. **At what value is normal environmental system pressure maintained?** (AFM)

   38 psi

9. **At what rate is temperature-controlled air delivered to the pressure vessel?** (AFM)

   8–16 ppm

10. **What is maximum sea level cabin altitude?** (AFM)

    10,500 feet

11. **What is the design service ceiling?** (AFM)

    25,000 feet

12. **What is the minimum N1 necessary to maintain adequate airflow in flight?** (AFM)

    75%

13. What are the tire pressures for the main gear and nose-gear tires? (AFM)

Main gear—95 psi

Nose gear—60 psi

14. What is the maximum tailwind component? (AFM)

10 knots

15. What is the maximum demonstrated crosswind component? (AFM)

25 knots

16. What is the maximum landing gear cycle limit? (AFM)

The gear may be cycled three times allowing 2 minutes between cycles. Each additional landing gear cycle requires a 5-minute interval between cycles.