

PRACTICE TEST 10: HYDRAULIC AND PNEUMATIC SYSTEMS

Instructions: Select the best answer for each question. Each question is based on the Airframe Mechanic Certification Standards

1. Pascal's Law states that pressure in a confined fluid:
 - A. Decreases with depth
 - B. Acts only downward
 - C. Is proportional to volume
 - D. Is transmitted equally in all directions
2. Hydraulic system advantage is achieved through:
 - A. Difference in piston areas creating mechanical advantage
 - B. Fluid compression
 - C. Temperature changes
 - D. Fluid color
3. Hydraulic pressure is measured in:
 - A. Gallons
 - B. Horsepower
 - C. Pounds per square inch (psi)
 - D. Feet per second
4. Typical aircraft hydraulic system pressure is:
 - A. 100-500 psi
 - B. 1,000-3,000 psi
 - C. 50-100 psi
 - D. 5,000-10,000 psi
5. Force in a hydraulic system equals:
 - A. Pressure times area
 - B. Pressure divided by area
 - C. Volume times pressure
 - D. Flow rate times time
6. Hydraulic fluid viscosity is:
 - A. Color property
 - B. Chemical composition

- C. Weight measurement
 - D. Resistance to flow (thickness)
7. MIL-H-5606 hydraulic fluid is:
- A. Synthetic
 - B. Petroleum-based, red colored
 - C. Water-based
 - D. Silicone
8. Skydrol (phosphate ester) hydraulic fluid is:
- A. Petroleum-based
 - B. Red colored
 - C. Fire-resistant synthetic fluid, purple colored
 - D. Water-soluble
9. Mixing incompatible hydraulic fluids causes:
- A. Improved performance
 - B. No problems
 - C. Better lubrication
 - D. Seal damage, gelling, and system failure
10. MIL-H-83282 hydraulic fluid is:
- A. Fire-resistant synthetic replacing Skydrol
 - B. Petroleum-based
 - C. Water-based
 - D. For automotive use
11. Hydraulic fluid flash point is:
- A. Freezing temperature
 - B. Temperature at which vapor ignites
 - C. Boiling point
 - D. Pour point
12. Hydraulic reservoir serves to:
- A. Generate pressure
 - B. Filter fluid
 - C. Store fluid, allow air separation, and thermal expansion
 - D. Actuate cylinders
13. Pressurized reservoirs use:
- A. Engine bleed air or hydraulic pressure maintaining positive pressure
 - B. Atmospheric pressure only
 - C. Vacuum
 - D. No pressure source

14. Reservoir standpipe prevents:
- A. Overfilling
 - B. Contamination
 - C. Leaks
 - D. Total fluid loss if leak occurs
15. Hydraulic pumps convert:
- A. Pressure to flow
 - B. Mechanical energy to hydraulic pressure and flow
 - C. Heat to pressure
 - D. Fluid to gas
16. Constant displacement pumps deliver:
- A. Variable flow
 - B. No flow
 - C. Fixed volume per revolution
 - D. Pressure only
17. Variable displacement pumps:
- A. Have fixed output
 - B. Cannot change flow
 - C. Require no control
 - D. Adjust output to maintain system pressure
18. Gear pumps use:
- A. Meshing gears trapping and moving fluid
 - B. Pistons
 - C. Vanes
 - D. Centrifugal force
19. Piston pumps provide:
- A. Low pressure only
 - B. High pressure capability and efficiency
 - C. No flow
 - D. Variable viscosity
20. Hand pump provides:
- A. Primary power
 - B. Automatic operation
 - C. Emergency backup hydraulic pressure
 - D. Cooling
21. Hydraulic system relief valve:
- A. Prevents excessive pressure by opening at set limit

- B. Controls flow direction
 - C. Filters fluid
 - D. Measures pressure
22. Check valve allows flow:
- A. In both directions
 - B. In no direction
 - C. Randomly
 - D. In one direction only
23. Shuttle valve:
- A. Stops all flow
 - B. Increases pressure
 - C. Selects between two pressure sources
 - D. Filters fluid
24. Priority valve ensures:
- A. All systems receive equal flow
 - B. Critical system receives flow first
 - C. No system receives flow
 - D. Pressure remains constant
25. Hydraulic fuse (flow limiter) automatically:
- A. Opens circuit
 - B. Filters fluid
 - C. Increases pressure
 - D. Shuts off flow if excessive indicating leak
26. Selector valve directs:
- A. Fluid to different actuators as selected
 - B. Pressure to relief valve
 - C. Return flow only
 - D. No fluid
27. Hydraulic actuating cylinders convert:
- A. Heat to motion
 - B. Pressure to electricity
 - C. Hydraulic pressure to linear motion
 - D. Rotary to linear motion
28. Single-acting cylinders:
- A. Work in both directions
 - B. Extend with pressure, retract by spring or gravity

- C. Have no return mechanism
 - D. Operate on vacuum
29. Double-acting cylinders:
- A. Use pressure for extension and retraction
 - B. Work by gravity only
 - C. Have single port
 - D. Cannot retract
30. Hydraulic motor converts:
- A. Linear motion to pressure
 - B. Heat to rotation
 - C. Electricity to motion
 - D. Hydraulic pressure to rotary motion
31. Accumulators store:
- A. Air only
 - B. Filters
 - C. Hydraulic energy under pressure
 - D. Heat
32. Piston-type accumulators use:
- A. Diaphragm separator
 - B. Piston separating gas and fluid
 - C. Bladder
 - D. No separator
33. Bladder accumulators contain:
- A. Fluid only
 - B. Spring
 - C. Heating element
 - D. Flexible bladder separating nitrogen gas and fluid
34. Accumulator nitrogen precharge:
- A. Must be checked with system depressurized
 - B. Uses oxygen
 - C. Is not important
 - D. Cannot be measured
35. Accumulators provide:
- A. Filtering only
 - B. Emergency pressure, shock absorption, flow supplement
 - C. Heating
 - D. Cooling only

36. Hydraulic filters remove:
- A. Pressure
 - B. Heat
 - C. Contaminants from fluid
 - D. Air only
37. Micron rating indicates:
- A. Filter particle size capability
 - B. Filter weight
 - C. Filter color
 - D. Flow rate
38. Bypass indicators on filters show:
- A. Normal operation
 - B. High temperature
 - C. Low pressure
 - D. Filter clogged, fluid bypassing
39. Suction filters located:
- A. After pump
 - B. Between reservoir and pump inlet
 - C. At actuators
 - D. In return lines
40. Return line filters clean:
- A. Pump inlet
 - B. High pressure
 - C. Fluid returning to reservoir
 - D. Nitrogen charge
41. Hydraulic system seals prevent:
- A. Pressure buildup
 - B. Flow
 - C. Cooling
 - D. Leakage between pressure areas
42. O-rings provide:
- A. Static and dynamic sealing
 - B. No sealing
 - C. Cooling
 - D. Filtration
43. Backup rings prevent:
- A. Leakage only

- B. Cooling
- C. O-ring extrusion at high pressure
- D. Installation

44. Packing seals are used for:

- A. Static seals only
- B. Dynamic sealing of moving shafts
- C. Electrical connections
- D. Filters

45. Wiper seals:

- A. Remove contaminants from extending rod
- B. Provide pressure
- C. Filter fluid
- D. Measure flow

46. Landing gear hydraulic operation uses:

- A. Pneumatic power only
- B. Manual operation
- C. Gravity only
- D. Hydraulic pressure to extend and retract

47. Landing gear up-locks:

- A. Prevent extension
- B. Secure gear in UP position
- C. Lower gear
- D. Provide emergency extension

48. Landing gear down-locks:

- A. Retract gear
- B. Prevent retraction
- C. Mechanically secure gear DOWN for landing
- D. Indicate gear position

49. Emergency gear extension typically uses:

- A. Gravity, manual pump, or stored pressure
- B. Engine power only
- C. Electrical system only
- D. Pneumatic system only

50. Hydraulic brake systems use:

- A. Engine vacuum
- B. Air pressure

- C. Mechanical linkage only
- D. Hydraulic pressure applied to brake discs/drums

51. Master cylinders in brake systems:

- A. Receive pressure from pedals
- B. Convert pedal motion to hydraulic pressure
- C. Cool brakes
- D. Store fluid only

52. Brake discs (rotors):

- A. Store pressure
- B. Generate heat
- C. Rotate with wheel, clamped by brake pads
- D. Contain fluid

53. Anti-skid systems prevent:

- A. Brake application
- B. Gear extension
- C. Steering
- D. Wheel lock-up during braking

54. Brake temperature indicators show:

- A. Brake disc temperature
- B. Fluid temperature
- C. Hydraulic pressure
- D. Wheel speed

55. Power brake control valve:

- A. Stops braking
- B. Measures temperature
- C. Meters hydraulic pressure proportional to pedal force
- D. Extends gear

56. Hydraulic power flight controls use:

- A. Mechanical linkage only
- B. Hydraulic actuators moving control surfaces
- C. Electric motors only
- D. Pneumatic power

57. Flight control hydraulic actuators:

- A. Position control surfaces with hydraulic power
- B. Generate pressure
- C. Store fluid
- D. Filter contamination

58. Hydraulic system leaks are classified as:
- A. Normal operation
 - B. Acceptable always
 - C. Safe to ignore
 - D. External (visible) or internal (across seals)
59. External leaks appear as:
- A. Pressure changes only
 - B. Temperature rise
 - C. Visible fluid loss, drips, or stains
 - D. No indication
60. Internal leaks cause:
- A. Visible drips
 - B. Reduced actuator performance, slower operation
 - C. No problems
 - D. Increased pressure
61. Hydraulic system troubleshooting starts with:
- A. Replacing pumps
 - B. Draining system
 - C. Flushing lines
 - D. Checking fluid level, pressure, and operation
62. Low system pressure indicates:
- A. Pump failure, relief valve issues, or leaks
 - B. Perfect operation
 - C. High temperature
 - D. Contamination only
63. Slow actuator operation suggests:
- A. High pressure
 - B. Internal leaks or low pressure
 - C. Perfect seals
 - D. Excess fluid
64. Air in hydraulic system causes:
- A. Improved operation
 - B. Faster response
 - C. Spongy feel, erratic operation, noise
 - D. No effects
65. Bleeding hydraulic systems removes:
- A. Entrapped air from system

- B. Pressure
- C. Fluid
- D. Heat

66. Hydraulic fluid contamination includes:

- A. Clean fluid only
- B. Additives
- C. Nitrogen
- D. Dirt, water, metal particles, wrong fluid

67. Water in hydraulic fluid causes:

- A. Improved lubrication
- B. Better cooling
- C. Corrosion and reduced lubrication
- D. No problems

68. Metal particles in fluid indicate:

- A. Normal operation
- B. Component wear requiring investigation
- C. Proper filtration
- D. Clean system

69. Hydraulic fluid sampling should:

- A. Never be done
- B. Use contaminated containers
- C. Ignore procedures
- D. Follow clean procedures preventing contamination

70. Hydraulic system flushing:

- A. Removes contamination using clean fluid
- B. Adds contaminants
- C. Is never needed
- D. Uses water

71. Pneumatic systems use:

- A. Hydraulic fluid
- B. Compressed air or nitrogen
- C. Water
- D. Vacuum only

72. Pneumatic system pressure typically:

- A. Exceeds hydraulic pressure
- B. Equals vacuum

- C. Ranges 50-150 psi
- D. Cannot be measured

73. Pneumatic systems are used for:

- A. Hydraulic backup only
- B. Cooling only
- C. Heating only
- D. De-icing boots, brakes, door seals, instruments

74. Compressor supplies:

- A. Compressed air to pneumatic system
- B. Hydraulic pressure
- C. Vacuum
- D. Heat

75. Pneumatic system moisture separator:

- A. Adds moisture
- B. Measures temperature
- C. Removes water from compressed air
- D. Filters hydraulic fluid

76. Pneumatic pressure regulator:

- A. Generates pressure
- B. Maintains desired system pressure
- C. Adds air
- D. Removes air

77. De-icing boots inflated by:

- A. Hydraulic pressure
- B. Manual pump
- C. Gravity
- D. Pneumatic pressure breaking ice

78. Pneumatic brake systems use:

- A. Compressed air actuating brakes
- B. Hydraulic fluid
- C. Vacuum
- D. Electric motors

79. Pneumatic door seals:

- A. Use hydraulics
- B. Inflate to seal cabin doors
- C. Deflate for sealing
- D. Are not inflatable

80. Engine bleed air provides:
- A. Hydraulic power
 - B. Fuel pressure
 - C. Pneumatic pressure from engine compressor
 - D. Cooling only
81. Hydraulic component inspection includes:
- A. Checking for leaks, damage, security, wear
 - B. Ignoring leaks
 - C. Visual only, no testing
 - D. Random checks
82. Flexible hoses inspected for:
- A. Proper color only
 - B. Age only
 - C. Length only
 - D. Cracks, bulges, chafing, age deterioration
83. Rigid tubing checked for:
- A. Color
 - B. Weight
 - C. Cracks, dents, corrosion, proper support
 - D. Temperature only
84. Hydraulic actuator seals tested by:
- A. Visual inspection only
 - B. Pressure testing for leakage
 - C. Weighing
 - D. Color matching
85. Accumulator servicing requires:
- A. System pressurized
 - B. Random procedures
 - C. No safety measures
 - D. System depressurized, nitrogen service equipment
86. Nitrogen charging accumulators requires:
- A. Dry nitrogen, proper pressure per specifications
 - B. Oxygen
 - C. Compressed air
 - D. Hydraulic fluid
87. Hydraulic system servicing uses:
- A. Any fluid available

- B. Mixed fluids
- C. Clean, approved fluid through filters
- D. Contaminated fluid

88. Filter replacement schedule:

- A. Never needed
- B. Per manufacturer intervals or when clogged
- C. Random timing
- D. When convenient

89. Torque values for hydraulic fittings:

- A. Must follow specifications preventing leaks or damage
- B. Are not important
- C. Use maximum torque
- D. Hand tight only

90. Safety wire on hydraulic fittings:

- A. Is decorative
- B. Weakens connections
- C. Causes leaks
- D. Prevents loosening from vibration

91. Hydraulic system pressure testing verifies:

- A. Color
- B. Temperature
- C. System holds pressure, no leaks
- D. Viscosity

92. Leak check performed at:

- A. Zero pressure
- B. Operating pressure to detect leaks
- C. Low pressure only
- D. Shutdown

93. Functional testing confirms:

- A. Color match
- B. Proper weight
- C. Correct temperature
- D. All systems operate correctly

94. System cycling during testing:

- A. Exercises components through full range
- B. Is not needed

- C. Damages equipment
- D. Wastes time

95. Pressure gauge accuracy:

- A. Doesn't matter
- B. Should be verified with calibrated gauge
- C. Cannot be checked
- D. Is always perfect

96. Hydraulic system safety includes:

- A. Random procedures
- B. No precautions needed
- C. Relieving pressure, proper PPE, avoiding injection injury
- D. Ignoring hazards

97. High-pressure injection injury occurs when:

- A. Fluid under pressure penetrates skin
- B. Drinking fluid
- C. Touching reservoir
- D. Visual inspection

98. Phosphate ester fluid (Skydrol) contact:

- A. Is beneficial
- B. Causes no problems
- C. Improves skin
- D. Causes skin irritation requiring washing and protection

99. Hydraulic system depressurization:

- A. Is automatic
- B. Required before maintenance to prevent injury
- C. Not necessary
- D. Only for major repairs

100. Lockout/tagout procedures ensure:

- A. Faster work
- B. Random operation
- C. System cannot be operated during maintenance
- D. Continuous pressure

Answer Explanations

- 1. D. Is transmitted equally in all directions** Pascal's Law states that pressure applied to confined fluid is transmitted undiminished in all directions throughout the fluid, acting perpendicular to all surfaces. Foundation principle for hydraulic systems creating mechanical advantage.
- 2. A. Difference in piston areas creating mechanical advantage** Hydraulic mechanical advantage achieved through different piston areas. Small piston applying force creates pressure transmitted to larger piston multiplying force. Force ratio equals area ratio ($F_1/A_1 = F_2/A_2$).
- 3. C. Pounds per square inch (psi)** Hydraulic pressure measured in pounds per square inch (psi) indicating force per unit area. Other units include bar, pascals, or kilopascals depending on system and location.
- 4. B. 1,000-3,000 psi** Typical aircraft hydraulic systems operate at 1,000-3,000 psi, though some high-performance systems operate at 3,000-5,000 psi. Higher pressures allow smaller, lighter components for same force output.
- 5. A. Pressure times area** Force in hydraulic systems equals pressure times area ($F = P \times A$). Doubling pressure or area doubles force output. Fundamental relationship for calculating actuator forces.
- 6. D. Resistance to flow (thickness)** Viscosity is fluid's resistance to flow or internal friction, often described as "thickness." Proper viscosity essential for lubrication, sealing, and preventing leakage while allowing flow.
- 7. B. Petroleum-based, red colored** MIL-H-5606 is petroleum-based (mineral oil) hydraulic fluid, red colored, operating range -65°F to $+275^{\circ}\text{F}$. Widely used in general aviation, older aircraft systems.
- 8. C. Fire-resistant synthetic fluid, purple colored** Skydrol (phosphate ester) is fire-resistant synthetic hydraulic fluid, purple colored, used in transport aircraft where fire resistance critical. Higher flash point than petroleum fluids.
- 9. D. Seal damage, gelling, and system failure** Mixing incompatible hydraulic fluids causes catastrophic problems including seal swelling/deterioration, fluid gelling, precipitate formation, and complete system failure. Never mix different fluid types.
- 10. A. Fire-resistant synthetic replacing Skydrol** MIL-H-83282 is fire-resistant synthetic hydraulic fluid, newer formulation replacing earlier Skydrol types, improved properties including better seal compatibility and environmental characteristics.
- 11. B. Temperature at which vapor ignites** Flash point is lowest temperature where fluid vapors ignite when exposed to ignition source. Fire-resistant fluids have flash points over 400°F versus petroleum fluids around 300°F .

12. C. Store fluid, allow air separation, and thermal expansion Hydraulic reservoir stores fluid supply, allows air bubbles to separate and rise, provides space for thermal expansion, and may contain filters, heat exchangers, or fluid level indicators.

13. A. Engine bleed air or hydraulic pressure maintaining positive pressure Pressurized reservoirs use engine bleed air or hydraulic system pressure maintaining positive pressure (typically 25-50 psi) ensuring positive flow to pump inlet preventing cavitation at altitude.

14. D. Total fluid loss if leak occurs Reservoir standpipe (internal tube) ensures pump draws fluid from above bottom, leaving reserve fluid if external leak occurs, providing emergency fluid supply for safe landing.

15. B. Mechanical energy to hydraulic pressure and flow Hydraulic pumps convert mechanical energy from engine or electric motor to hydraulic energy creating pressure and flow. Positive displacement pumps trap and force fluid creating pressure.

16. C. Fixed volume per revolution Constant displacement pumps deliver fixed volume per revolution regardless of pressure (within limits). Flow rate proportional to RPM. Simple, reliable, but cannot adjust output to demand.

17. D. Adjust output to maintain system pressure Variable displacement pumps automatically adjust output stroke/angle maintaining constant pressure while varying flow to match demand. More efficient, reduces heat generation, commonly used in aircraft.

18. A. Meshing gears trapping and moving fluid Gear pumps use two meshing gears trapping fluid between teeth and housing, carrying it from inlet to outlet. Simple, reliable, moderate pressure capability, used for utility systems.

19. B. High pressure capability and efficiency Piston pumps provide highest pressure capability (3,000-5,000 psi), excellent efficiency, long life, commonly used in aircraft main hydraulic systems. Axial or radial piston designs.

20. C. Emergency backup hydraulic pressure Hand pumps provide emergency backup hydraulic pressure for critical functions (landing gear, brakes) if primary system fails. Manual operation allows limited system operation for safe landing.

21. A. Prevents excessive pressure by opening at set limit Relief valve protects system from excessive pressure by opening at predetermined limit (typically 10-15% above normal operating pressure), returning fluid to reservoir preventing damage.

22. D. In one direction only Check valve allows free flow in one direction while preventing reverse flow. Spring-loaded ball or poppet seals against seat blocking reverse flow, commonly used preventing backflow.

23. C. Selects between two pressure sources Shuttle valve automatically selects higher of two pressure sources directing it to common outlet. Used in redundant systems allowing either system to power actuators.

24. B. Critical system receives flow first Priority valve ensures critical system (flight controls) receives adequate flow before non-essential systems (landing gear, flaps). Maintains flight control capability when pump capacity limited.

25. D. Shuts off flow if excessive indicating leak Hydraulic fuse (flow limiter) automatically shuts off flow if rate exceeds preset limit indicating line rupture or major leak, isolating failure preventing total system fluid loss.

26. A. Fluid to different actuators as selected Selector valve directs hydraulic fluid to different actuators based on pilot input position. Spool or rotary design routes pressure and return lines to selected function.

27. C. Hydraulic pressure to linear motion Hydraulic actuating cylinders (linear actuators) convert hydraulic pressure to linear motion by applying pressure to piston in cylinder, producing force and motion for landing gear, flaps, etc.

28. B. Extend with pressure, retract by spring or gravity Single-acting cylinders use hydraulic pressure for one direction (typically extension), returning by spring or gravity. Simpler, lighter than double-acting, adequate for many applications.

29. A. Use pressure for extension and retraction Double-acting cylinders use hydraulic pressure for both extension and retraction through ports on both sides of piston, providing positive control in both directions, common for flight controls.

30. D. Hydraulic pressure to rotary motion Hydraulic motors convert hydraulic pressure and flow to continuous rotary motion, similar to pump operating in reverse. Used for flap drives, cargo doors, and auxiliary equipment.

31. C. Hydraulic energy under pressure Accumulators store hydraulic energy under pressure using compressed gas (nitrogen) acting on fluid. Provide emergency pressure, supplement pump flow, absorb pressure spikes, dampen pulsations.

32. B. Piston separating gas and fluid Piston-type accumulators use free-floating piston separating nitrogen gas from hydraulic fluid. Piston moves as pressure changes, simple design, but subject to seal leakage.

33. D. Flexible bladder separating nitrogen gas and fluid Bladder accumulators use flexible rubber bladder containing nitrogen gas, surrounded by hydraulic fluid. Bladder expands/contracts with pressure changes, preventing gas mixing with fluid.

34. A. Must be checked with system depressurized Accumulator nitrogen precharge checked with hydraulic system completely depressurized, measuring gas pressure with special gauge. Precharge typically 1/3 to 2/3 system operating pressure.

35. B. Emergency pressure, shock absorption, flow supplement Accumulators provide emergency pressure reserve if pump fails, absorb shock and pressure spikes protecting components, supplement pump flow during high demand periods.

36. C. Contaminants from fluid Hydraulic filters remove contaminants (dirt, metal particles, seal fragments, water) preventing component wear, valve malfunction, and system damage. Critical for system reliability and longevity.

37. A. Filter particle size capability Micron rating indicates smallest particle size filter captures. Lower number means finer filtration. Aircraft hydraulic filters typically 10-25 micron, critical systems use 3-10 micron.

38. D. Filter clogged, fluid bypassing Bypass indicators (pop-out buttons or flags) show when filter element clogged and fluid bypassing unfiltered. Indicates immediate filter replacement required preventing accelerated component wear.

39. B. Between reservoir and pump inlet Suction filters located between reservoir and pump inlet protecting pump from large contaminants. Must have low restriction preventing pump cavitation, typically coarse filtration.

40. C. Fluid returning to reservoir Return line filters clean fluid returning to reservoir removing contamination generated by system operation (wear particles, seal fragments). Fine filtration protects entire system.

41. D. Leakage between pressure areas Hydraulic seals prevent leakage between high and low pressure areas, maintaining system efficiency and preventing fluid loss. Critical for proper actuator operation and system pressure.

42. A. Static and dynamic sealing O-rings provide both static sealing (non-moving joints) and dynamic sealing (moving parts at low pressure/speed). Simple, economical, available in various materials for different fluids.

43. C. O-ring extrusion at high pressure Backup rings prevent O-ring extrusion into clearance gaps at high pressures. Hard plastic or Teflon rings support O-ring preventing damage, essential for pressures over 1,500 psi.

44. B. Dynamic sealing of moving shafts Packing seals used for dynamic sealing of reciprocating or rotating shafts, providing adjustable seal preventing leakage while allowing motion. Multiple rings provide progressive sealing.

45. A. Remove contaminants from extending rod Wiper seals (scraper seals) remove dirt, moisture, and contaminants from cylinder rod as it extends, preventing contamination from entering cylinder when rod retracts.

- 46. D. Hydraulic pressure to extend and retract** Landing gear hydraulic operation uses hydraulic pressure extending and retracting gear, providing reliable positive control. Emergency backup typically uses gravity, manual pump, or stored pressure.
- 47. B. Secure gear in UP position** Landing gear up-locks mechanically secure gear in retracted position preventing accidental extension in flight. Released hydraulically or mechanically during normal gear extension.
- 48. C. Mechanically secure gear DOWN for landing** Landing gear down-locks mechanically secure gear in extended position for landing, independent of hydraulic pressure. Visual and tactile indicators verify positive lock engagement.
- 49. A. Gravity, manual pump, or stored pressure** Emergency gear extension typically uses gravity (releasing up-locks allowing gear to free-fall), manual hydraulic pump, or accumulator stored pressure ensuring gear extends if hydraulic failure occurs.
- 50. D. Hydraulic pressure applied to brake discs/drums** Hydraulic brake systems use hydraulic pressure from pilot pedal input actuating brake calipers clamping pads against rotating discs (or shoes against drums) creating friction stopping wheels.
- 51. B. Convert pedal motion to hydraulic pressure** Master cylinders convert mechanical pedal force to hydraulic pressure. Piston in cylinder pressurizes fluid transmitting force to brake actuators proportional to pedal application.
- 52. C. Rotate with wheel, clamped by brake pads** Brake discs (rotors) attach to wheel rotating with it. Hydraulic calipers clamp stationary brake pads against rotating disc converting kinetic energy to heat through friction.
- 53. D. Wheel lock-up during braking** Anti-skid systems prevent wheel lock-up during braking by sensing wheel deceleration, automatically reducing brake pressure when impending skid detected, maximizing braking efficiency and directional control.
- 54. A. Brake disc temperature** Brake temperature indicators show brake disc temperature, warning of overheating from excessive braking. High temperatures can cause brake fade, tire damage, or brake fire.
- 55. C. Meters hydraulic pressure proportional to pedal force** Power brake control valve meters hydraulic system pressure to brakes proportional to pilot pedal force, providing power-assisted braking with pilot feel while allowing full system pressure when needed.
- 56. B. Hydraulic actuators moving control surfaces** Hydraulic power flight controls use hydraulic actuators (servo actuators) moving ailerons, elevators, rudder in response to pilot inputs. Essential for large/high-speed aircraft requiring significant control forces.
- 57. A. Position control surfaces with hydraulic power** Flight control hydraulic actuators position control surfaces with hydraulic power, overcoming aerodynamic loads. Feedback systems ensure accurate positioning matching pilot input commands.

58. D. External (visible) or internal (across seals) Hydraulic leaks classified as external (visible fluid escape from system) or internal (fluid bypassing seals within component). External obvious; internal detected by performance degradation.

59. C. Visible fluid loss, drips, or stains External leaks appear as visible fluid dripping, spray, or stains on components and structure. Require immediate attention to prevent fluid loss, fire hazard, and environmental contamination.

60. B. Reduced actuator performance, slower operation Internal leaks cause reduced actuator performance, slower operation, drift under load, or inability to hold pressure. Fluid bypasses seals internally without visible external leakage.

61. D. Checking fluid level, pressure, and operation Hydraulic troubleshooting starts with basics: verify adequate fluid level, check system pressure, observe operation, check circuit breakers, and inspect for visible leaks before detailed troubleshooting.

62. A. Pump failure, relief valve issues, or leaks Low system pressure indicates pump not producing adequate flow, relief valve opening prematurely, excessive system leakage, or obstruction restricting flow to pressure source.

63. B. Internal leaks or low pressure Slow actuator operation suggests internal seal leakage allowing fluid bypass, insufficient system pressure, excessive load, or contamination causing valve malfunction.

64. C. Spongy feel, erratic operation, noise Air in hydraulic system causes spongy, compressible feel (air compresses unlike liquid), erratic operation, noisy pump operation (cavitation), and reduced efficiency requiring bleeding.

65. A. Entrapped air from system Bleeding hydraulic systems removes entrapped air by operating system while opening bleed valves at high points, allowing air bubbles to escape until solid fluid flows.

66. D. Dirt, water, metal particles, wrong fluid Hydraulic fluid contamination includes particulate contamination (dirt, metal wear particles, seal fragments), water, wrong fluid type, or chemical breakdown products degrading performance and causing wear.

67. C. Corrosion and reduced lubrication Water in hydraulic fluid causes corrosion of metal components, reduces lubrication effectiveness, promotes bacterial growth in some fluids, and can freeze blocking passages.

68. B. Component wear requiring investigation Metal particles in hydraulic fluid indicate component wear (pump, actuator, valve), requiring investigation to identify source and extent of damage before catastrophic failure occurs.

69. D. Follow clean procedures preventing contamination Hydraulic fluid sampling requires clean procedures using clean sample bottles, drawing samples from designated ports, avoiding contamination during sampling for accurate analysis.

70. A. Removes contamination using clean fluid Hydraulic system flushing circulates large volumes of clean fluid removing contamination after component failure, major maintenance, or when switching fluid types, using fine filters.

71. B. Compressed air or nitrogen Pneumatic systems use compressed air or nitrogen gas for power transmission and actuation. Lower pressure than hydraulics (typically 50-150 psi), compressible, fire-safe.

72. C. Ranges 50-150 psi Pneumatic system pressure typically 50-150 psi, much lower than hydraulic systems. Lower pressure requires larger actuators for same force but simpler, lighter components.

73. D. De-icing boots, brakes, door seals, instruments Pneumatic systems power de-icing boots, some brake systems, pressurized door seals, cabin pressurization, some instruments (gyros), and various actuators where fire resistance desired.

74. A. Compressed air to pneumatic system Compressor (engine-driven or electric) supplies compressed air to pneumatic system from ambient air, raising pressure and storing in receiver tanks for distribution.

75. C. Removes water from compressed air Pneumatic moisture separator removes water vapor condensed during compression preventing corrosion, freezing, and contamination. Uses centrifugal separation, coalescing filters, or desiccant.

76. B. Maintains desired system pressure Pneumatic pressure regulator maintains desired downstream pressure regardless of supply pressure or flow variations, protecting components and ensuring consistent operation.

77. D. Pneumatic pressure breaking ice De-icing boots use pneumatic pressure inflating rubber boots on wing/tail leading edges, breaking accumulated ice which airflow removes. Cyclical inflation/deflation removes ice buildup.

78. A. Compressed air actuating brakes Pneumatic brake systems use compressed air (instead of hydraulic fluid) actuating brake mechanisms, common on large aircraft providing fire-resistant brake power.

79. B. Inflate to seal cabin doors Pneumatic door seals inflate creating pressure seal around cabin doors when pressurized, ensuring airtight closure preventing pressure loss and improving noise insulation.

80. C. Pneumatic pressure from engine compressor Engine bleed air tapped from engine compressor stages provides high-pressure, high-temperature pneumatic power for anti-icing, pressurization, air conditioning, and pneumatic systems.

81. A. Checking for leaks, damage, security, wear Hydraulic component inspection includes checking for fluid leaks, physical damage, secure mounting, wear indicators, proper safety wiring, correct fluid level, and pressure settings.

82. D. Cracks, bulges, chafing, age deterioration Flexible hoses inspected for cracks in outer cover, bulges indicating internal failure, chafing from vibration, age deterioration, proper routing without excessive bending, and secure fittings.

83. C. Cracks, dents, corrosion, proper support Rigid tubing checked for cracks at flares and bends, dents restricting flow, corrosion especially at fittings, proper support preventing vibration fatigue, and correct routing.

84. B. Pressure testing for leakage Hydraulic actuator seals tested by applying pressure and observing for fluid bypass (internal leakage), checking for drift under load, and verifying holding capability.

85. D. System depressurized, nitrogen service equipment Accumulator servicing requires system completely depressurized, using proper nitrogen service equipment with pressure gauge, never using oxygen (fire hazard) or compressed air (moisture contamination).

86. A. Dry nitrogen, proper pressure per specifications Nitrogen charging accumulators requires dry nitrogen (moisture-free) at specified precharge pressure (typically 1/3 to 2/3 operating pressure) using calibrated charging equipment.

87. C. Clean, approved fluid through filters Hydraulic system servicing uses only clean, approved fluid type matching system requirements, filtered during filling, avoiding contamination from dirty containers or environment.

88. B. Per manufacturer intervals or when clogged Filter replacement follows manufacturer-specified intervals (hours or calendar time) or when bypass indicator shows clogging, whichever occurs first, maintaining system cleanliness.

89. A. Must follow specifications preventing leaks or damage Torque values for hydraulic fittings must follow specifications exactly; insufficient torque causes leaks, excessive torque damages threads, flares, or fittings potentially causing failures.

90. D. Prevents loosening from vibration Safety wire on hydraulic fittings prevents loosening from vibration, installed so tension on wire tightens rather than loosens fitting, using proper techniques and materials.

91. C. System holds pressure, no leaks Hydraulic system pressure testing verifies system holds specified pressure without leakage, components function properly under pressure, and relief valves operate at correct settings.

92. B. Operating pressure to detect leaks Leak check performed at normal operating pressure (or test pressure if higher) to detect leaks that may not appear at low pressure, inspecting all connections, seals, hoses.

93. D. All systems operate correctly Functional testing confirms all hydraulic systems (landing gear, flaps, brakes, etc.) operate correctly, proper sequencing, adequate speed, full travel, and proper indications.

94. A. Exercises components through full range System cycling during testing exercises components through complete operating range multiple times ensuring proper operation, detecting intermittent problems, and verifying full functionality.

95. B. Should be verified with calibrated gauge Pressure gauge accuracy verified using calibrated master gauge comparing readings at multiple pressures ensuring accurate system pressure indication and proper troubleshooting information.

96. C. Relieving pressure, proper PPE, avoiding injection injury Hydraulic system safety includes always relieving pressure before disconnecting lines, wearing eye protection and gloves, avoiding high-pressure injection injuries, and proper fluid handling.

97. A. Fluid under pressure penetrates skin High-pressure injection injury occurs when hydraulic fluid under pressure (even small pinhole leaks at 1,000+ psi) penetrates skin injecting fluid into tissue, requiring immediate medical treatment.

98. D. Causes skin irritation requiring washing and protection Phosphate ester fluid (Skydrol) contact causes skin irritation, removes natural skin oils, requires immediate washing with soap and water, protective gloves and clothing mandatory when handling.

99. B. Required before maintenance to prevent injury Hydraulic system depressurization required before maintenance disconnecting lines or components preventing high-pressure fluid spray, injection injury, or violent actuator movement.

100. C. System cannot be operated during maintenance Lockout/tagout procedures ensure hydraulic systems cannot be inadvertently operated during maintenance through physical locks on controls and warning tags preventing injury from unexpected movement.