Naval Education and
Training Command

NAVEDTRA 82964
July 1990
0503-LP-213-2400

Nonresident
Training Course
(NRTC)

Fluid Power

Only one answer sheet is included in the NRTC. Reproduce the required number of sheets you need or get answer sheets from your ESO or designated officer.

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0503LP2132400

Reviewed and approved for continued use on
19 February 1992.

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COMMANDING OFFICER
NETPDTC
6490 SAUFLEY FIELD RD
PENSACOLA, FL 32509-5237

ERRATA #3 19 Oct 99
Stock Ordering No.
0503-LP-213-2403

Specific Instructions and Errata for
Nonresident Training Course

FLUID POWER, NAVEDTRA 82964

1. This errata supersedes all previous erratas. No attempt has been made to issue corrections for errors in typing, punctuation, etc ., that do not affect your ability to answer the question or questions.

2. To receive credit for deleted questions, show this errata to your local course administrator (ESO/scorer). The local course administrator is directed to correct the course and the answer key by indicating the question deleted.

3. Assignment Booklet, NAVEDTRA 82964.

Delete the following questions, and leave the corresponding spaces blank on the answer sheets:

Questions	Questions
2-6	4-52
2-9	5-22
2-15	5-67
3-5	

Make the following changes:

Question	Change
1-19	In the questions, change the question to read "In the metric system, the density of a substance is expressed as…"
1-52	In the question, line 5, “60 cubic centimeters” is equivalent to 60 milliliters.
3-32	In the blurb before the question, line 2, delete “and 3-33.”
4-15	In alternative 3, change “form” to “from.”
4-18	In the question. line 2, change “instead” to “installed.”
4-28	In alternative 2, change “el” to “element.”
5-8	In the blurb preceding the question, line 1, change “1-8” to “5-8.”
5-52/5-55	In the column under “COMPONENTS”, in alternative 3, add “mover” after “prime.”
5-67	In the blurb preceding the question, line 2, change “5-71” to “ 5-70.”

FLUID POWER

NAVEDTRA 82964

Prepared by the Naval Education and Training Program Management
Support Activity, Pensacola, Florida

Congratulations! By enrolling in this course, you have demonstrated a desire to improve yourself and the Navy. Remember, however, this self-study course is only one part of the total Navy training program, Practical experience, schools, selected reading, and your desire to succeed are also necessary to successfully round out a fully meaningful training program. You have taken an important step in self-improvement. Keep up the good work.

HOW TO COMPLETE THIS COURSE SUCCESSFULLY

ERRATA : If an errata comes with this course, make all indicated changes or corrections before you start any assignment. Do not change or correct the training manual (TRAMAN) or assignments in any other way.

TEXTBOOK ASSIGNMENTS: The TRAMAN for this course is Fluid Power, NAVEDTRA 12964. The TRAMAN pages that you are to study are listed at the beginning of each assignment. Study these pages carefully before attempting to answer the questions in the course, pay close attention to tables and illustrations because they contain information that will help you understand the text. Read the learning objectives provided at the beginning of each chapter or topic in the text and/or preceding each set of questions in the course. Learning objectives state what you should be able to do after studying the material Answering the questions correctly helps you accomplish the objectives.

BLACK DOT INFORMATION: Black dots (●) may be used in the text and correspondence course to emphasize important or supplemental information and to highlight instructions for answering certain questions. Read these black dot entries carefully; they will help you answer the questions and understand the material,

SELECTING YOUR ANSWERS: After studying the text, you should be ready to answer the questions in the assignment. Read each question carefully; then select the BEST answer. Be sure to select your answer from the subject matter in the TRAMAN. You may refer freely to the TRAMAN and seek advice and information from others on problems that may arise in the course. However, the answers must be the result of your own work and decisions, You are prohibited from referring to or copying the answers of others and from giving answers to anyone else taking the same course. Failure to follow these rules can result in suspension from the course and disciplinary action.

SUBMITTING COMPLETED ANSWER SHEETS: Complete all assignments as quickly as possible to derive maximum benefit from the course. As a minimum, you must submit at least one assignment per month. This is a requirement established by the Chief of Naval Education and Training. Failure to meet this requirement could result in your disenrollment from the course.

TYPES OF ANSWER SHEETS: If you are a U.S. Navy enlisted member on active duty Or a drilling U.S. Naval Reserve enlisted member, you should use the anawer sheet attached at the end of this course and follow the instructions in section A below. If you are an enlisted U.S. Naval Reserve member who is not attached to a drilling unit or if you are officer, a civilian, or a member of the U.S. Army, Air Force, Marine Corps, or Coast Guard, you should use the Automatic Data Processing (AD? answer sheets included in the course package and follow the instruction in section B on the next page.

A. Manually Scored Answer Sheets

If you are a U.S. Navy enlisted member on active duty or attached to a U.S. Naval Reserve drilling unit, your course will be administered by your local command You must use the answer sheet designed for manual scoring, NETPMSA form 1430/5, Stock Ordering Number 0502-LP-216-0100. You may get a supply of the forms from your ESO or you may reproduce the one in the back of this course booklet. DO NOT USE THIS FORM FOR COURSES ADMINISTERED BY NETPMSA.

Recording Information on the Manually Scored Answer Sheets: As you complete each assignment, submit the completed answer sheet to your local educational services officer

(ESO) for grading. You may submit more than one answer sheet at a time. Remember, you must submit at least one assignment each month.

Grading: Your ESO will grade each answer sheet and notify you of any incorrect answers The passing score for each assignment is 3.2. If you receive less than 3.2 on any assignment, the ESO will list the questions you answered incorrectly and give you a pink answer sheet marked RESUBMIT. You must redo the assignment and complete the RESUBMIT answer sheet The maximum score you can receive for a resubmitted assignment is 3.2.

Course Completion: After you have submitted all the answer sheets and have earned at least 3.2 on each assignment, your command should give you credit for this course by making the appropriate entry on Page 4 of your service record.

Student Ouestions: If you should have questions concerning the administration of this course consult your local ESO.

B. ADP Answer sheets

If you are an enlisted U.S. Naval Reserve member who is not attached to a drilling reserve unit or if you are an officer, a civilian, or a member of the U.S. Army, Air Force, Marine Corps, or Coast Guard, you should use the ADP answer sheets provided in your course package. You should use one blank original ADP answer sheet for each assignment. Use only the original ADP answer sheets provided in your course package. NETPMSA will not accept reproductions.

Recording information on the ADP Answer Sheets: Carefully follow the MARKING INSTRUCTIONS on each answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information identifies you (the student), the course, and the assigment: it must be correct for NETPMSA to process your course and give you credit for your work.

Because your ADP answer sheets will not be returned to you, be sure to mark your answers in the course booklet as you are working the course. Whenever you complete an assignment, transfer your answers from the course booklet to the ADP answer sheet.

Hailing the Completed ADP Answer Sheets: Upon completing an assignment mail the completed answer sheet to:

Commanding Officer
Naval Education and Training
Program Management Support
Activity
Pensacola, FL 32559-5000

Use envelopes to mail your answer sheets. You must provide your own envelopes or request them from your local educational services officer (ESO). You may enclose more than one answer sheet in a single envelope. Remember. regardless of how many answer sheets you submit at a time. NETPMSA should receive at least one assignment a month. NOTE: DO NOT USE THE COURSE COMMENTS PAGE AS AN ENVELOPE FOR RETURNING ANSWER SHEETS OR OTHER COURSE MATERIALS.

Grading: NETPMSA will grade your answer sheets and notify you by letter concerning your grade for each assignment, your incorrect answers, and your final grade. The passing score for each assignment is 3.2. If you receive less than 3.2 on any assignment, you must rework the assignment. NETPMSA will enclose a new ADP answer sheet in the letter notifying you of the questions you answered incorrectly. You will be required to redo the assignment and resubmit the new answer sheet The maximum score you can receive for a resubmitted assignment is 3.2.

Course Completion: When you complete the last assignment, fill out the Course Competion form in the back of the course and enclosed it with your last answer sheet. NETPMSA will issue you a letter certifying that you satisfactorily completed the course. You should make sure that credit for the course is recorded in your service record.

NOTE: YOUR OFFICIAL COURSE COMPLETION DATE WILL BE THE DATE YOUR LAST ASSIGNMENT IS PROCESSED THROUGH NETPMSA'S ADP SYSTEM--NOT THE DATE YOU DEPOSIT THE LAST ASSIGNMENT IN THE MAIL. This is especially important if you are taking the course for Naval Reserve retirement credit. You must mail your answer sheets at least 60 days before your anniversary date. This will provide you with enough time for delays in the mail or reworking failed assignments. DO NOT MAIL YOUR ASSIGNMENTS TO THE NAVAL RESERVE PERSONNEL COMMAND (NRPC).

Student Questions: If you have questions concerning this course, notify NETPMSA by mail (use the address listed above) or by telephone: AUTOVON 922-1366 or commercial (904) 452-1366.

NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you will receive retirement points if you are authorized to receive them under current directives governing retirement of Naval Reserve personnel. For the purpose of Naval Reserve retirement, this edition of the course is evaluated at B points. These points will be credited to you upon your satisfactory

completion of the entire course. You will not receive retirement points for retaking this course unless it has been designated as a major revision.

NOTE: YOUR OFFICIAL COURSE COMPLETION DATE WILL BE THE DATE YOUR LAST ASSIGNMENT IS PROCESSED THROUGH NETPMSA'S ADP SYSTEM--NOT THE DATE YOU DEPOSIT THE LAST ASSIGNMENT IN THE MAIL. Refer to the Course Completion paragraph under section B. ADP Answer Sheets,

COURSE OBJECTIVES

When you complete this course, you will be able to show a basic understanding of the following topics associated with fluid power and fluid power systems: fundamental physics as appropriate to fluids at rest and in motion; types and characteristics of hydraulic and pneumatic fluids; major components of basic fluid power systems and diagrams used to illustrate these systems; proper procedures and precautions for handling and replacing lines, connectors, and sealing devices; proper procedures for eliminating contaminants; purpose, operation, application of pumps, reservoirs, strainers, filters, accumulators, flow control and measuring devices, directional control valves, and actuators; arrangement and operation of representative fluid power systems including the function and interrelationship of major components.

Naval courses may include several types of questions—multiple-choice, true-false, matching, etc. The questions are not grouped by type but by subject matter. They are presented in the same general sequence as the textbook material upon which they are based. This presentation is designed to preserve continuity of thought, permitting step-by-step development of ideas. Not all courses use all of the types of questions available. The student can readily identify the type of each question, and the action required, by inspection of the samples given below.

MULTIPLE-CHOICE QUESTIONS

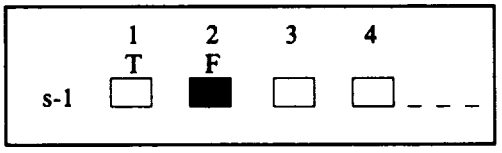
Each question contains several alternatives, one of which provides the best answer to the question. Select the best alternative, and blacken the appropriate box on the answer sheet.

SAMPLE

s-1. Who was the first person appointed Secretary of Defense under the National Security Act of 1947?

1. George Marshall
2. James Forrestal
3. Chester Nimitz
4. William Halsey

Indicate in this way on the answer sheet:



TRUE-FALSE QUESTIONS

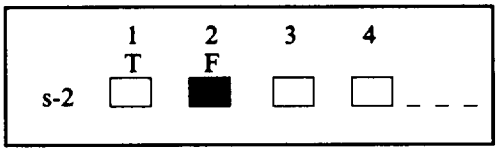
Mark each statement true or false as indicated below. lf any part of the statement is false the statement is to be considered false. Make the decision, and blacken the appropriate box on the answer sheet.

SAMPLE

s-2. All naval officers are authorized to correspond officially with any systems command of the Department of the Navy without their respective commanding officer's endorsement.

1. True
2. False

Indicate in this way on the answer sheet:



MATCHING QUESTIONS

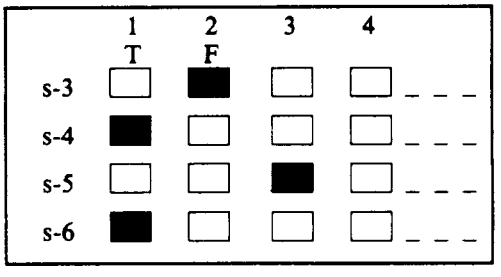
Each set of questions consists of two columns, each listing words, phrases or sentences. The task is to select the item in column B which is the best match for the item in column A that is being considered. Items in column B maybe used once, more than once, or not at all. Specific instructions are given with each set of questions. Select the numbers identifying the answers and blacken the appropriate boxes on the answer sheet.

SAMPLE

In questions s-3 through s-6, match the name of the shipboard officer in column A by selecting from column B the name of the department in which the officer functions. Some responses maybe used once, more than once, or not at all.

A. OFFICER	B. DEPARTMENT
s-3. Damage Control Assistant	1. Operations Department
s-4. CIC Officer	2. Engineering Department
s-5. Disbursing Officer	3. Supply Department
s-6. Communications Officer	

Indicate in this way on the answer sheet:



Assignment 1

Textbook Assignment: "Fluid Power," chapter 1; "Forces in Liquids," chapter 2; "Hydraulic Fluids, " chapter 3, pages 3-1 through 3-6.

Learning Objective: Recognize the scope of the text and the breadth of the topic, Fluid Power, including pertinent definitions, applications and fundamental concepts.

1-1. The term "fluid power" includes hydraulics and pneumatics, and is power that is applied through liquids or gases pumped or compressed to provide force and motion to mechanisms.

1. True
2. False

1-2. The purpose of your textbook, Fluid Power, is to provide you with

1. a basic guide for use in maintaining hydraulic equipment
2. a basic reference concerning fundamentals of fluid power
3. information on fluid power application for specific equipment
4. a reference concerning advanced concepts of fluid power

1-3. Which of the following is a favorable characteristic of a fluid power system?

1. Very large forces can be controlled by much smaller ones
2. Different parts of the system can be located at widely separated points
3. Motion can be transmitted without the slack inherent in the use of solid machine parts
4. Each of the above

IN ANSWERING QUESTIONS 1-4 THROUGH 1-6, SELECT FROM COLUMN B THE SYSTEM THAT MEETS THE PRESSURE AND CONTROL REQUIREMENTS LISTED IN COLUMN A.

	A. Requirements	B. Systems
1-4.	A medium amount of pressure and fairly accurate control	1. Hydraulic 2. Pneumatic
1-5.	A medium amount of pressure and more accurate control	3. Combination hydraulic and pneumatic
1-6.	A great amount of pressure and/or extremely accurate control	

1-7. Which of the following is a special problem of fluid power systems?

1. Loss in efficiency as the force of the fluid is conveyed up and down or around corners
2. Loss of force as the fluid is transmitted over considerable distances
3. Leaks
4. Each of the above

1-8. The study of hydraulics was originally confined to the study of the physical behavior of water at rest and in motion. The term "hydraulics" now includes the physical behavior of all

1. liquids
2. gases
3. liquids and gases
4. liquids, gases, and solids

1-9. Pascal's law pertains to the

1. construction of aqueducts
2. use of water wheels for doing work
3. differences of floating and submerged bodies
4. transmission of force in confined fluids

IN QUESTIONS 1-10 THROUGH 1-12, SELECT FROM COLUMN B THE TYPE OF POWER USED IN EACH ITEM OF EQUIPMENT OR SYSTEM LISTED IN COLUMN A.

	A EQUIPMENT	B. POWER TYPES
1-10.	Dental Chair	1. Hydraulic
1-11.	Anchor Windlass	2. Hydro-pneumatic
1-12.	Service station lift	3. Pneumatic

Learning Objective: Identify the states of matter and the factors affecting them.

1-13. All matter is classified according to its state as a solid, a liquid, or a gas.

1. True
2. False

1-14. The critical factors affecting the state of matter are

1. temperature and weight
2. pressure and density
3. density and specific gravity
4. pressure and temperature

Learning Objective: Recognize the pressure characteristics of liquids, including how pressure is caused by the weight of the atmosphere, and identify how pressures are measured.

1-15. Pressure can be measured in terms of force per unit area.

1. True
2. False

1-16. Mark each of the following statements, concerning the atmosphere and atmospheric pressure, true or false; then select the alternative below that lists the statements that are true.

A. The troposphere is that part of the atmosphere touching the earth's surface
B. The atmosphere has weight.
C. Atmospheric pressure decreases as altitude decreases.
D. Atmospheric pressure at points below sea level is less than at sea level.

1. A and B
2. B and C
3. C and D
4. A, B, C, and D

1-17. The reference standard used as an indicator of atmospheric pressure is a column of mercury that at sea level is

1. 76 inches high at 0°C
2. 76 centimeters high at 4°C
3. 76 centimeters high at 0°C
4. 29.92 inches high at 4°C

1-18. The side of a thin-walled chamber partially evacuated of air is the source of movement for the

1. hydrometer
2. aneroid barometer
3. mercury thermometer
4. Fahrenheit thermometer

Learning Objective: Identify terms and facts applicable to the physics of fluids and use these facts with related formulas to solve problems pertaining to density and specific gravity.

1-19. In the metric system the density of a substance is its weight in

1. grams per cubic foot
2. pounds per cubic foot
3. grams per cubic centimeter
4. pounds per cubic centimeter

1-20. What change, if any, will occur in the volume and weight of a substance if its temperature changes?

1. Both its volume and weight will change
2. Both its volume and weight will be unaffected
3. Its volume will change, but its weight will remain constant
4. Its weight will change, but its volume will remain constant

1-21. Which statement about specific gravity is false?

1. The density of a solid can be determined by multiplying its specific gravity times the density of water
2. Specific gravity can also be described as specific weight or specific density
3. Specific gravity of a substance should be measured at a standardized temperature and pressure
4. Specific gravity will vary with the size of the sample being tested

1-22. How can the specific gravity of a liquid or solid be expressed?

1. As a ratio between the weight of the substance and the density of a volume of water
2. As a ratio between the weight of the substance and the weight of an equal volume of water
3. As the number that shows the density of the substance in the metric system
4. As in 2 and 3 above

1-23. What is the specific gravity of a liquid which weighs 44 pounds per cubic foot at 4°C?

1. 0.440
2. 0.624
3. 0.705
4. 0.789

1-24. What is the density of a solid that has a specific gravity of 2.5?

1. 156 pounds per cubic foot
2. 250 pounds per cubic foot
3. 312 pounds per cubic foot
4. 482 pounds per cubic foot

1-25. What is the specific gravity of a solid object which weighs 49.92 pounds per cubic foot?

1. 0.789
2. 0.8
3. 2.7
4. 0.9

1-26. A device used for measuring the specific gravity of a liquid is known as a

1. hydrography
2. hydrometer
3. hydrostat
4. hydroscope

Learning Objective: Recognize the principles and equations involved with the transmission of forces, and solve related problems.

1-27. The pressure of force exerted on the end of a rigid metal bar is applied equally and undiminished to all surfaces of the bar.

1. True
2. False

1-28. The head, or pressure due to the weight of a fluid, depends on the density of the fluid and the

1. area of the bottom surface of the container
2. total volume of the fluid
3. vertical height of the fluid
4. geometric shape of the container

REFER TO FIGURE 2-11 OF YOUR TEXTBOOK IN ANSWERING QUESTIONS 1-29 AND 1-30, WHICH DEAL WITH THE MULTIPLICATION OF FORCES IN POWER SYSTEMS.

1-29. Assume that the input piston has an area of 3 square inches with a force of 45 pounds. What is the pressure in the system?

1. 5 psi
2. 10 psi
3. 15 psi
4. 20 psi

1-30. Assume that the output piston has a diameter of 6 inches and is subject to a pressure of 10 pounds per square inch. What is the force exerted on the output piston?

1. 28.26 pounds
2. 31.4 pounds
3. 282.6 pounds
4. 314.0 pounds

Refer to figure 1A in answering questions 1-31 and 1-32. The rule applying to the action of the piston states that the force acting on the piston surface area from chamber C is proportional to the pressure in chamber C times the area of the piston head. The force acting on the piston from chamber D is proportional to the pressure in chamber D times the effective area of the piston head (which is the cross-sectional area of the piston minus the cross-sectional area of the piston shaft.) The piston surface in chamber C is 25 square inches, and the effective area in chamber D is 20 square inches.

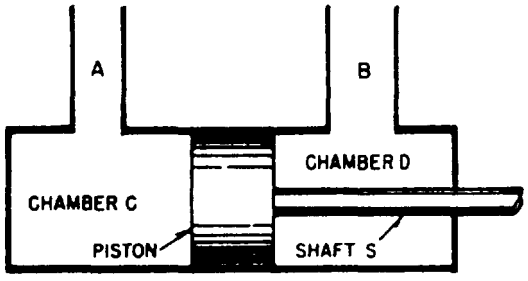


Figure 1A

1-31. The pressure in line A is 200 psi. No force is exerted on shaft S. How much pressure will be required in line B to prevent the piston from moving?

1. 160 psi
2. 200 psi
3. 250 psi
4. 500 psi

1-32. Lines A and B are pressurized to 50 psi. How much force is applied to each surface and which way will the piston move?

1. C = 1250 pounds, D = 1000 pounds, piston will move to the right
2. C = 1250 pounds, D = 1000 pounds, piston will move to the left
3. C = 1000 pounds, D = 1250 pounds, piston will move to the right
4. C = 1000 pounds, D = 1250 pounds, piston will move to the left

1-33. For two pistons in the same fluid power system, the distances moved are inversely proportional to the

1. pressure of the fluid
2. volume of fluid moved
3. expansion of the fluid
4. areas of the pistons

Learning Objective: Recognize the characteristics and behavior of fluids in motion, including methods for measuring volume and velocity, and relate the dynamic and static factors involved with fluid flow.

1-34. In fluid power syetems using liquids, the measurement of the volume of fluid flow is made in units of

1. cubic inches per minute
2. gallons per minute
3. cubic feet per minute
4. cubic yards per minute

1-35. Water flows through a pipe of 5 square-inch cross section at the velocity of 3 feet per second (fps). At what velocity does it flow through a constriction in the pipe with a cross section of 3 square inches?

1. 1.8 fps
2. 3.0 fps
3. 3.6 fps
4. 5.0 fps

1-36. Two pistons with different cross-sectional areas will travel at the same speed as long as the rate of fluid flow into their cylinders is identical.

1. True
2. False

1-37. In streamline flow, each particle of fluid moves in what manner?

1. In uniform helical swirls
2. In parallel layers
3. At a velocity proportional to the cross-sectional area of the pipe
4. At the same velocity in the center of the pipe as along the walls

1-38. Losses due to friction increase with velocity at a higher rate in turbulent flow than in streamline flow.

1. True
2. False

1-39. What is inertia of fluids in a power system?

1. The resistance of the fluid to movement or change of rate of movement
2. The force required to maintain the fluid at constant velocity
3. The capacity to move and change rate of flow
4. The force required to overcome friction

1-40. Neglecting friction, how much force is required to accelerate 3 pounds of fluid from rest to a velocity of 322 feet per second in 2 seconds?

1. 1.5 pounds
2. 3.0 pounds
3. 15 pounds
4. 30 pounds

ANSWER QUESTIONS 1-41 THROUGH 1-45 AS TRUE OR FALSE BASED ON THE RELATIONSHIP OF FORCE, PRESSURE, AND HEAD.

1-41. Head is a statement of force per unit area.

1. True
2. False

1-42. Velocity head is the loss of energy caused by inertia.

1. True
2. False

1-43. Gravity head depends on which portions of the system are exposed to open air.

1. True
2. False

1-44. Friction head cannot exist without velocity head.

1. True
2. False

1-45. There can be no static head if the fluid is in motion.

1. True
2. False

1-46. Which factors affecting fluid action are classified as static factors?

1. Applied forces, inertia, and friction
2. Atmospheric pressure, applied forces , and inertia
3. Gravity, applied forces, and friction
4. Gravity, atmospheric pressure, and applied forces

1-47. Refer to figure 2-18 in your textbook. If this were a practical situation, the pressure in chamber A would be greater than that in chamber B by the amount of pressure required to

1. absorb inertia
2. prevent the fluid from moving
3. overcome friction
4. raise the pressure at an intermediate point

Learning Objective: Recognize similarities and differences between pneumatic and hydraulic fluid power systems, and indicate operating characteristics and component functions of basic fluid power systems.

1-48. The similarity between hydraulic and pneumatic fluid power systems is correctly indicated by which of the following statements?

1. The basic components of the systems are essentially the same
2. Both systems depend upon internal lubrication by the system fluid
3. Both 1 and 2 above correctly indicate the similarity
4. The basic components of the systems are identical and interchangeable

1-49. Which component of a hydraulic fluid power system performs the same function as the receiver in a pneumatic fluid power system?

1. Reservoir
2. Compressor
3. Actuator
4. Selector valve

Learning Objective: Identify the characteristic of liquid that makes it desirable for use in hydraulic systems and properties and characteristics that must be considered in selecting a hydraulic liquid for a particular system, including related data.

1-50. Liquids rather than gases are used in hydraulic systems because liquids are

1. more compressible
2. less compressible
3. more expensive
4. less corrosive to system components

1-51. A liquid that is satisfactory for use in a hydraulic system provides

1. a low viscosity index, good sealing quality, and lubricity
2. a high viscosity index, good sealing quality, and a low flashpoint
3. good lubrication and sealing qualities, and a viscosity that does not result in an increase in flow resistance in" system piping
4. good lubrication and a viscosity that decreases as temperature increases

1-52. The viscosity reading of a liquid is expressed as Saybolt universal seconds (SUS), which represents the time, in seconds, it takes for 60 cubic centimeters of the liquid at a specified temperature to pass through an orifice of given diameter.

1. True
2. False

1-53. A low V.I. indicates that a liquid will

1. maintain a constant viscosity over a wide temperature range
2. vary greatly in viscosity with changes in temperature
3. vary only slightly in viscosity with changes in temperature
4. have a response to temperature changes very much like the response of paraffinic oil

1-54. Which of the following statements is NOT a true statement of fluid viscosity?

1. An ideal fluid viscosity remains constant throughout temperature changes
2. The average hydraulic fluid has a relatively low viscosity
3. There is a large choice of liquids available for the viscosity range required
4. Liquids derived from the same source have equal resistance to heat

1-55. The film strength and lubricating qualities of a liquid are directly related to the liquid's physical properties.

1. True
2. False

1-56. Which statement about a hydraulic liquid that is continuously subjected to high temperature conditions is true?

1. It accumulates moisture
2. It changes unfavorably in composition
3. Its life is unaffected by the hours of use
4. The carbon and sludge formed in it are of little concern if the reservoir temperature remains normal

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IN QUESTIONS 1-57 THROUGH 1-59, SELECT FROM COLUMN B THE DEFINITION OF EACH PROPERTY OF LIQUIDS LISTED IN COLUMN A.

	A. Properties	B. Definitions
1-57.	Fluidity	1. The internal resistance that tends to prevent liquids from. flowing
1-58.	Viscosity	2. The quality, state, or degree of liquids being poisonous
1-59.	Chemical stability	3. The physical property that enables liquids to flow
		4. The ability of liquids to resist oxidation and deteriora-tion for long periods

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1-60. The desirable flashpoint of a hydraulic liquid is one which provides a

1. low degree of evaporation and good resistance to combustion
2. high degree of evaporation and poor resistance to combustion
3. low degree of evaporation and low resistance to combustion
4. high degree of evaporation and high resistance to combustion

1-61. Hydraulic liquid must possess which of the following properties?

1. Chemical stability and freedom from acidity
2. Lubricating ability and proper viscosity
3. Minimum toxicity and high flashpoint
4. All of the above

1-62. Although manufacturers strive to produce hydraulic liquids that contain no toxic chemicals, some liquids contain chemicals that are harmful. How do these poisonous chemicals enter the body?

1. Absorption through the skin
2. Through the eyes or mouth
3. Through inhalation
4. All of the above

Learning Objective: Recognize various types of hydraulic liquids and their particular characteristics and uses.

1-63. The bases of the most common types of hydraulic liquids are classified as

1. synthetic, water, or vegetable
2. water , petroleum, or synthetic
3. water , petroleum, or vegetable
4. petroleum, vegetable, or synthetic

1-64. What is the moat widely used medium for hydraulic systems?

1. Petroleum-based liquid
2. Synthetic-based liquid
3. Vegetable-based liquid
4. Water-based liquid

1-65. Which of the following properties of a hydraulic liquid can be improved by additives?

1. viscosity
2. Chemical stability
3. Lubricating power
4. All of the above

1-66. The fluid currently being used in a hydraulic system that requires a nonflammable liquid will probably be a

1. synthetic-based liquid
2. blend of water and oil
3. petroleum-based liquid
4. blend of petroleum and vegetable oil

1-67. Which of the following statements is/are true concerning synthetic-based fluids?

1. They will not burn
2. They are compatible with most commonly used packing and gasket materials
3. They may contain toxic chemicals
4. All of the above

1-68. You have accidentally gotten a synthetic hydraulic fluid in your eyes . You should flush your eyes for at LEAST 15 minutes and seek immediate medical attention.

1. True
2. False

1-69. You are required to dispose of contaminated synthetic fluid while deployed. How should you dispose of the fluid?

1. Pump it to the collecting, holding, and transfer (CHT) tank
2. Place it in drums for disposal ashore
3. Pump it over the side
4. Dilute it with soapy water and pump it over the side

1-70. Water-based fluids' resistance to fire depends on the vaporization and smothering effect of steam generated from water.

1. True
2. False

Assignment 2

Textbook Assignment: "Hydraulic Fluids," chapter 3, pages 3-6 through 3-11; "Pumps," chapter 4; and "Fluid Lines and Fittings," chapter 5, pages 5-1 through 5-11.

Learning Objective: Identify types, characteristic, origin, control, and checks for various hydraulic system contaminants.

2-1. Trouble develops in a hydraulic system when the fluid becomes contaminated as the result of

1. system component deterioration
2. friction at hotspots
3. abrasive wear
4. any action that places foreign matter in the fluid

2-2. By which of the following ways may air enter into a hydraulic system?

1. Through improper maintenance
2. Past leaky seals in gas-pressurized accumulators
3. Past actuator piston rod seals
4. Each of the above

2-3. Water contamination of a hydraulic system is NOT a major concern since its presence aids in reducing the flammability of the fluid.

1. True
2. False

2-4. Chemical contamination of hydraulic liquid by oxidation is indicated when the liquid contains which of the following materials?

1. Sludge
2. Asphaitine particles
3. Organic acids
4. Each cf the above

2-5. Compatibility of hydraulic liquid with the seals and hoses in a system prevents which of the following problems from occurring?

1. Gum formation around the seals and within the hoses
2. Deposits of contaminants on the seals and within the hoses
3. Condensation of moisture within the system
4. Chemical reaction between the liquid acid the seal or hose material and consequent breakdown of these parts

2-6. All of the following contaminants are abrasive EXCEPT

1. lint
2. rust
3. sludge
4. sand particles

2-7. Whenever drained or used hydraulic fluid is returned to a system, straining is necessary only if the cleanliness of the storage container is questionable.

1. True
2. False

2-8. Which of the following agents should parts of a hydraulic component be cleaned with prior to being assembled?

1. An approved dry-cleaning solvent
2. Trichlorotrifluoroethane
3. Chlorinated solvents
4. Trichlorofluoromethane

2-9. Which of the following agents, if combined with minute amounts of water found in operating hydraulic systems, does NOT change into hydrochloric acid?

1. An approved dry-cleaning solvent
2. Trichlorotrifluoroethane
3. Chlorinated solvents
4. Trichlorofluoromethane

2-10. When you analyze operating hydraulic fluids, changes in which of the following areas may be of particular interest to you?

1. Chemical properties
2. physical properties
3. particulate contamination
4. Any of the above

2-11. From which of the following locations can fluid samples be taken?

1. Filter bowls
2. Tops of tanks
3. Pipe drains after sufficient fluid has drained
4. Each of the above

Learning Objective: Indicate functions, operating characteristics, and related data pertinent to hydraulic pumps.

2-12. Which of the following is the function of a hydraulic pump?

1. To provide flow to the hydraulic system
2. To create the pressure required in a hydraulic system
3. To control the pressure required in a hydraulic system
4. To compensate for atmospheric pressure at varying altitudes

2-13. If a hydraulic pump is located below the reservoir, fluid is supplied to its inlet port by which of the following forces?

1. Fluid head
2. Gravity
3. Atmospheric pressure
4. A combination of all of the above

2-14. The ratings of most hydraulic pumps are determined by their

1. efficiency
2. output per unit time
3. volumetric output at a given pressure
4. amount of internal slippage

2-15. Pump performance can be expressed in which of the following terms?

1. Gallons per minute
2. Cubic inches per revolution
3. Both 1 and 2 above
4. Cubic feet per minute

2-16. In contrast to a nonpositive-displacement pump that can operate with its discharge outlet completely restricted, a positive-displacement pump cannot do so and must be used with a pressure regulator.

1. True
2. False

Learning Objective: Identify operating principles and construction features of rotary pumps

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2-17. Slippage is the term given to the amount of fluid that can return from the discharge side to the suction side of a rotary pump through the space or clearances between the stationary and moving parts.

1. True
2. False

2-18. Which of the following is generally the basis for rotary pump classification?

1. Type of drive
2. Shaft position
3. Service application
4. Type of rotating element

2-19. What type of gears is illustrated in figure 4-1 of your textbook?

1. Spur
2. Helical
3. Crescent
4. Herringbone

2-20. Which type of gear-type rotary pumps discharges the smoothest fluid flow?

1. Spur
2. Helical
3. Herringbone
4. Crescent

2-21. Why are helical gear pumps classified as external gear pumps?

1. Both sets of teeth project inward toward the center of the gears
2. Both sets of teeth project outward from the center of the gears
3. The teeth of the interior gear project inward toward the center of the gears, and the teeth of the exterior gear project outward from the center of the gears
4. The teeth of the interior gear project outward from the center of the gears, and the teeth of the exterior gear project inward toward the center of the gears

2-22. Refer to figure 4-2, view B, in your textbook, What determines the volume delivery of this pump?

1. The size of the crescent
2. The size of the internal gear
3. The speed of rotation of the crescent
4. The speed of rotation of the drive gear

2-23. Refer to figure 4-7 In your textbook. The vanes of the lobe pump are used for which of the following purposes?

1. To reduce wear of the pump caused by surface to surface contact
2. To provide a good seal between the lobes and the point of lobe junction in the center of the pump
3. To provide a good seal between the lobes and the chamber
4. To do both 2 and 3 above

2-24. The pump illustrated In figure 4.9 of your textbook is designated as unbalanced because the pumping action is done by one side of the shaft and rotor.

1. True
2. False

2-25. Which, if any, of the following statements is true of a screw pump ?

1. Its performance is based on the fluid' s viscosity
2. It is very efficient
3. The idler rotors are connected by gears
4. None of the above

Learning Objective: Recognize functions, principles of operation, and construction features of various types of reciprocating pumps.

REFER TO FIGURE 4-10 IN YOUR,TEXTBOOK IN ANSWERING QUESTIONS 2-26 AND 2-27.

2-26. This type of pump is used in some aircraft hydraulic systems to provide a source of hydraulic power for what purpose(s)?

1. Emergencies
2. Testing certain subsystems during preventive maintenance
3. Determining the causes of malfunctions in certain subsystems
4. All of the above

2-27. Why is liquid discharged through the outlet port when the piston is moved to the right?

1. The piston rod makes the inlet chamber smaller than the outlet chamber
2. Check valve B opens, admitting liquid to the inlet port and outlet port through check valve A
3. Check valve A opens, causing the liquid confined in the inlet chamber to flow to the smaller outlet chamber and out the outlet port
4. Check valve A closes, causing the liquid confined in the inlet chamber to flow to the outlet chamber and out the outlet port

REFER TO FIGURE 4-11 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 2-28 THROUGH 2-30.

2-28. Which of the following components will revolve during the operation of this pump?

1. Cylinder block
2. Slide block
3. Both 1 and 2 above
4. Pintle

2-29. The pumping action of this pump is obtained by which of the following actions?

1. Rotating the pintle at the center of the cylinder block
2. Moving the cylinder block off center from the axis of the pintle
3. Positioning the sliding block to provide unequal travel of the pistons in the cylinder block
4. Moving the rotor and reaction ring to provide unequal piston travel radially around the cylinder block

2-30. In which of the following piston positions will the cylinder have taken on a full charge of liquid?

1. Position 1, view D
2. Position 2, view A
3. Position 3, view C
4. Position 4, view B

2-31. Pulsations of fluid flow from a radial-piston pump are much greater if the pump has an even number of pistons than if it has an odd number.

1. True
2. False

2-32. Which of the following components of a radial-piston pump is connected to the cylinder block?

1. Rotor
2. Pintle
3. Piston
4. Drive shaft

REFER TO FIGURE 4-15 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 2-33 AND 2-34,

2-33. The rocker arm will be perpendicular to the shaft when the shaft has been rotated how far?

1. One-quarter of a turn only
2. One-half of a turn
3. Three-quarters of a turn only
4. Either one-quarter or three-quarters of a turn

2-34. Starting from the position of the shaft as indicated in figure 4-15, view G, how many times will rod A be pushed out and pulled in through the wheel during each shaft revolution?

1. Once
2. Twice
3. Four times
4. Eight times

2-35. The output of the axial-piston pump is determined by which of the following factors?

1. Number of pistons
2. Length of the piston rods
3. Length of the drive shaft
4. Angle given to the tilting plane

2-36. What component of a Stratopower pump holds the pistons in constant contact with the mechanical drive mechanism?

1. Wobble plate
2. Creep plate
3. Check spring
4. Piston return spring

2-37. Automatic variation of the volume output of a variable-displacement Stratopower pump is controlled by which of the following factors?

1. Atmospheric pressure
2. Reciprocating action of the pistons
3. The position of the rocker arm on the shaft
4. The pressure in the hydraulic system

2-38. During nonflow operation of a variable-displacement Stratopower pump, what provides its lubrication?

1. Compensator spring
2. Compensator piston
3. Bypass system
4. Drive cam

Learning Objective: Indicate basic requirements for fluid power system lines and connectors, and recognize pertinent facts concerning identification, sizing, uses, and construction of pipe and tubing.

2-39. You must consider which of the following factors when selecting the types of fluid lines for a particular fluid power system?

1. The required pressure of the system
2. The type of fluid medium
3. The location of the system
4. All of the above

2-40. You must give primary consideration to all but which of the following factors in selecting the lines for a particular fluid power system?

1. The type of material
2. The material's wall thickness
3. The material's inside diameter
4. The material's outside diameter

2-41. Replacement of a piece of tubing with one having a smaller inside diameter will result in which of the following conditions?

1. Fluid heating
2. Turbulent fluid flow
3. System power loss
4. All of the above

2-42. Which, if any, of the following statements is true for pipes of the same nominal size?

1. As the pipe schedule size increases, the ID remains the same and the wall thickness and OD increase
2. As the pipe schedule size increases, the ID increases, the wall thickness decreases, and the OD remains the same
3. As the pipe schedule size increases, the ID decreases, the wall thickness increases, and the OD remains the same
4. None of the above

REFER TO TABLE 5-1 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 2-43 AND 2-44.

2-43. The nominal size of pipe whose outside diameter is 1.900 inches is

1. 1 1/2
2. 1 3/4
3. 2
4. 2 1/4

2-44. What is the schedule 40 wall thickness of pipe with a nominal pipe size of 2 inches?

1. 0.154 In.
2. 0.218 in.
3. 0.308 in.
4. 0.436 in.

2-45. What is the size of No. 4 rigid tubing, and where is the measurement taken?

1. 0.004 inch, wall thickness
2. 0.040 inch, wall thickness
3. 4/16 inch, inside diameter
4. 1/4 inch, outside diameter

2-46. Which statement about the relative bursting pressure for various sizes of tubing made of the same material is true?

1. It is different for each wall thickness regardless of size
2. It is the same for all sizes having the same wall thickness
3. It is lower for small tubing than for larger tubing of the same wall thickness
4. It is higher for small tubing than for larger tubing of the same wall thickness

2-47. Which of the following metals may be used to provide a strong, inexpensive pipe or tubing capable of withstanding high pressures and temperatures?

1. Steel
2. Copper
3. Stainless steel
4. Aluminum

2-48. Which of the following basic requirements must be considered in designing the lines and connectors of a fluid power system?

1. Inside surfaces that do not create turbulent fluid flow
2. Sizes sufficient to deliver adequate quantities of fluid to all components
3. Strength to withstand pressure surges that exceed the system' s working pressure
4. All of the above

2-49. Bends in piping serve to absorb vibration and to compensate for thermal expansion and contraction.

1. True
2. False

2-50. The determining factor for the radius of the bend to be made in a pipe is the pipe's

1. length
2. wall thickness
3. inside diameter
4. outside diameter

2-51. Coarse-toothed hacksaw blades are preferred for cutting tubing because they cut faster and are less liable to choke up with the chips.

1. True
2. False

2-52. Which of the following procedures should you follow when cutting a tube with a tube cutter?

1. Apply continual light pressure to the cutting wheel
2. Remove all burrs on the inside and outside of the tube
3. Remove all foreign particles from the tube
4. All of the above

2-53. Which of the following statements is NOT correct for cutting tubing with a hacksaw?

1. A fine-tooth hacksaw of 48 teeth per inch could be used
2. When you clamp the tubing in a vice, tighten the vice until the tubing is just starting to hold without collapsing
3. All hacksaw marks must be removed by filing

2-54. What parts of the hand tube bender are used to obtain the correct bend radius and the desired bend angle on tubing?

1. The clip and the slide bar
2. The radius block and the slide bar
3. The radius block and the clip
4. The forming bar and the slide bar

2-55. Which of the following statements is NOT true concerning the flaring of a tube?

1. The flare must be large enough to seat properly against the fitting
2. The correct diameter of the flare is obtained by ensuring that the tube is flush with the top face of the die block
3. The flare must be small enough to allow the threads of the flare nut to slide over it

Learning Objective: Recognize characteristics, uses, construction features, and installation procedures of flexible hose.

2-56. Flexible hose should be used in locations where it will be subjected to

1. intense heat
2. severe vibration
3. excessive abrasion
4. an oily environment

2-57. Which of the following information is found along the layline of synthetic rubber hoses having a rubber cover?

1. Hose size
2. Cure date
3. Federal supply code
4. All of the above

2-58. The size of flexible hose is designated In what increments measured at what place?

1. Thousandths of an inch," outside diameter,
2. Thousandths of an inch, inside diameter
3. Sixteenths-inch, outside, diameter
4. Sixteenths-inch, Inside diameter

2-59. The flexible hose that is inert to all fluids presently used and that does not absorb water is composed of what material?

1. PTFE
2. Natural rubber
3. Synthetic rubber
4. Rubber impregnated cotton or nylon

2-60. You have completed fabrication of a flexible hose assembly. Which, if any, of the following steps must you NOT perform?

1. Proof test the assembly
2. Ensure that the hose is compatible with system fluid
3. Flush and dry the hose and cap its ends
4. None of the above

2-61. Mark each of the following statements about the correct installation and use of flexible hose as true or false, then select the alternative below that lists the true statements.

A. Sharp bends may reduce the bursting pressure of the hose
B. Supports are never required when the hose is used.
C. The hose should be stretched tightly between connecetions.
D. The hose should be wrapped where necessary for protection against chafing.

1. A and D
2. A and C
3. B and D
4. B and C

2-62. A characteristic of flexible hose is that under pressure it will

1. expand in both diameter and length
2. retain its manufactured dimensions
3. expand in diameter and contract in length
4. contract in diameter and expand in length

Assignment 3

Textbook Assignment: "Fluid Lines and Fittings," chapter 5, pages 5-11 through 5-21; "Valves," chapter 6; and Sealing Devices and Materials," chapter 7.

Learning Objective: Recognize uses, construction features, operational characteristics and procedures, functions, and precautionary measures associated with fluid power system connectors.

QUESTIONS 3-1 THROUGH 3-4 CONCERN THE USE OF THREADED CONNECTORS IN FLUID POWER CIRCULATORY SYSTEMS.

3-1. The threads of newly threaded pipe do not corrode if the fittings cover all of the exposed threading.

1. True
2. False

3-2. Pipe compounds prevent corrosion and assist in the disassembly of threaded joints.

1. True
2. False

3-3. Excess pipe compound that may ooze inside lines does not present problems if the compound is compatible with the fluid in the system.

1. True
2. False

3-4. The use of threaded connectors is generally limited to low-pressure systems.

1. True
2. False

IN ANSWERING QUESTIONS 3-5 THROUGH 3-7, SELECT FROM COLUMN B THE TYPE OF CONNECTOR TO WHICH EACH STATEMENT IN COLUMN A APPLIES. NOT EVERY CONNECTOR IN COLUMN B IS USED.

	A. STATEMENTS	B. CONNECTORS
3-5.	This connector is attached to the piping by welding, brazing, tapered thread , or rolling and bending	1. Brazed 2. Flared 3. Welded 4. Flange
3-6.	This connector connects sub-assemblies in some fluid power systems, especially in high--pressure systems that use pipe for the fluid lines	
3-7.	This connector is commonly used for joining nonferrous piping in the pressure and temperature range where its use is practical	

3-8. The fitting of a flared connector should be made of material having greater strength than that of its sleeve and nut and of the piping.

1. True
2. False

3-9. A universal fitting is one that can be

1. positioned to the angle required for the installation
2. adapted to operate with any size tubing
3. positioned to any angle in any plane
4. routed through a bulkhead

IN QUESTIONS 3-10 THROUGH 3-13, SELECT FROM COLUMN B THE CONNECTOR TO WHICH EACH STATEMENT CONCERNING TIGHTENING DATA IN COLUMN A APPLIES.

A. TIGHTENING DATA	B. CONNECTORS
3-10. This connector tightened 1/6 turn past the specified torque	1. Flareless type
3-11. This connector may not be tightened past the specified torque	2. Aluminum alloy flared type
3-12. This connector must be preset prior to being tightened	3. Steel flared type
3-13. This connector must be turned with a wrench 1/6 turn past handtight	

3-14. Quick-disconnect couplings are provided with an automatic shutoff feature which prevents loss of fluid from the system or entrance of foreign matter into the system when they are disconnected.

1. True
2. False

3-15. Manifolds are used in the pressure supply and/or return lines of fluid power systems to perform which of the following functions?

1. Conserve space
2. Reduce joints
3. Eliminate piping
4. All of the above

3-16. In long pieces of tubing or pieces bent to a complex shape, rust and scale can be removed by what process?

1. Degaussing
2. Pickling
3. Scraping
4. Sandblasting

Learning Objective: Identify functions of valves in a fluid power system; also recognize functions, operating characteristics, and construction features of various types of flow control valves.

3-17. Valves are used to control which of the following in fluid power systems?

1. Direction of fluid flow
2. Fluid pressure
3. Fluid flow
4. All of the above

IN ANSWERING QUESTIONS 3-18 THROUGH 3-20, SELECT FROM COLUMN B THE TYPE OF FLOW CONTROL VALVE MOST CLOSELY IDENTIFIED WITH EACH STATEMENT IN COLUMN A.

A. STATEMENTS	B. TYPES
3-18. Its flow is controlled by raising or lowering discs or wedges	1. Ball
	2. Gate
	3. Globe
3-19. Flow or no-flow through it is controlled by turning the valve shaft one-quarter turn	4. Needle
3-20. Certain types are used as variable restrictors	

3-21. Gate valves are suitable for use as throttling valves because they close in small increments.

1. True
2. False

3-22. The globe valve gets its name from the globular shape of its body, a shape that is unique to this valve.

1. True
2. False

3-23. Approximately how far must the handwheel of a globe valve be turned toward the closed position after the valve has been fully opened?

1. 1/4 turn
2. 1/2 turn
3. 3/4 turn
4. 7/8 turn

3-24. What type of flow control valve makes the most suitable throttle valve?

1. Gate
2. Plug
3. Globe
4. Needle

Learning Objective: Relate the operation, functions, requirements, and construction characteristics of pressure control devices to fluid power systems.

3-25. Relief valves are used for which of the following functions?

1. To maintain pressures above a predetermined level
2. To maintain fluid flow below a predetermined rate
3. To prevent pressure from rising above a predetermined level
4. To prevent thermal expansion of the fluids

3-26. If a fluid power system uses two or more relief valves, they must all be the same size.

1. True
2. False

3-27. Chatter in a relief valve is the result of

1. rapid opening and closing of the valve as it 'hunts' above and below a set pressure
2. too much difference between opening and closing pressures of the valve
3. concurrent operation of the small relief valve and the main relief valve
4. improper seating of the valve element

REFER TO FIGURE 6-13 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 3-28 AND 3-29 CONCERNING THE OPERATION OF A COMPOUND RELIEF VALVE.

3-28. When the system pressure increases above the pressure to which the valve is set, the main valve opens

1. independently of the pilot valve
2. only after the system pressure increases to more than can be relieved by the pilot valve
3. concurrently with the pilot valve
4. every time the pilot valve opens but at a predetermined time interval afterward

3-29. After the main valve has relieved the system and when pressure returns to normal, what does the pilot valve do?

1. It remains open until after the main valve closes
2. It closes simultaneously with the main valve
3. It closes first and allows pressure to equalize above and below the main piston
4. It closes first and causes pressure above the main piston to force the main valve closed

3-30. A hydraulic pressure regulator does which of the following?

1. Maintains the system pressure between two predetermined levels
2. Regulates the quantity of fluid flow in the system
3. Maintains the system pressure above a predetermined pressure level
4. Maintains the system pressure below a predetermined pressure level

3-31. Chatter of a pressure regulator may be prevented by

1. using a constant displacement pump
2. installing a snubber in the fluid supply line
3. maintaining a very small differential pressure
4. making cutout (closing) pressure higher than cutin (opening) pressure

REFER TO FIGURE 6-14 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 3-32 AND 3-33.

3-32. What is the operational state of the regulator when the system pressure is less than that required to operate one of the activating units in the system?

1. The pilot valve is seated, the check valve is unseated, and fluid is flowing into the system
2. The pilot valve is unseated, the check valve is seated, and fluid is flowing into the system
3. The check valve is unseated, the pilot valve is seated, and fluid is flowing into the return line
4. The check valve is unseated, the pilot valve is unseated, and fluid is flowing into the system and into the return line

3-33. For the pressure-controlled sequence valve to operate properly, the tension of the spring must be sufficient to hold the piston in the closed position against pressure required to operate the primary unit.

1. True
2. False

3-34. Refer to figure 6–17 in your textbook. Under what condition does the valve operate as a conventional check valve?

1. Any time pressure in port A is greater than the pressure in port B
2. Any time the pressures in port A and port B are equal
3. Only when the plunger is depressed
4. Only when the plunger is released

3-35. Refer to figure 6-18 in your textbook. The valve decreases fluid flow when which of the following conditions exist(s)?

1. The pressure in the outlet port exceeds the adjusting spring pressure
2. The pressure in the inlet port exceeds the pressure desired in the outlet port
3. The pressure on the valve diaphragm moves the valve stem up to close the valve
4. All of the above

REFER TO FIGURE 6-19 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 3-36 AND 3-37.

3-36. If the input pressure of the inlet port is less than the setting of the pressure reducing valve, what should be the respective positions of the poppet valve and the spool valve?

1. Open, open
2. Open, closed
3. Closed, closed
4. Closed, open

3-37. A restriction in the drain would cause the outlet port pressure to

1. pulsate
2. increase
3. decrease
4. remain the same

3-38. The following statements concern the operation of the counterbalance valve shown in figure 6-20 of your textbook. Mark each statement true of false, then select the alternative below that lists those that are true.

A. The main valve has equal surfaces which are the inner areas of the spool.
B. The activation of the valve results from the applied pressure opening the check valve, allowing the fluid to bypass the main valve.
C. Reverse action of the valve is controlled by the pressure required to overcome the spring tension of a check valve.
D. The weight supported by the valve depends upon the spring tension on the spool.

1. A, B, C
2. A, C, D
3. B, C, D
4. A, D

Learning Objective: Recognize construction features, operating characteristics, and uses of various types of directional control valves.

3-39. A poppet is used as the valving element for which of the following fluid power valve applications?

1. Flow control
2. Pressure control
3. Directional control
4. All of the above

3-40. What type of valving element is most commonly used in directional control applications?

1. Ball
2. Poppet
3. Rotary spool
4. Sliding spool

3-41. Check valves usually contain what types of valving elements?

1. Ball and cone
2. Ball and poppet
3. Sleeve and poppet
4. Rotary spool and sliding spool

3-42. What type of check valve permits free flow of fluid in one direction and a limited flow of fluid in the opposite direction?

1. Orifice
2. Vertical
3. Swing
4. Ball

3-43. Refer to figure 6-25 in your textbook. Force caused by which of the following plays no part in the opening and closing of this valve?

1. Gravity
2. Spring action
3. Backflow of fluid
4. Forward flow of fluid

3-44. Refer to figure 6-27 in your textbook. If normal system inlet pressure is lost, when the alternate system is activated, its pressure will cause the shuttle to move sufficiently to

1. close the outlet port to prevent reverse flow from the outlet port to the normal system inlet
2. close the outlet port and connect the normal system inlet to the alternate system inlet
3. apply the alternate system pressure to both the outlet port and the normal system
4. close the normal system inlet to prevent loss of alternate system pressure

3-45. Refer to figure 6-28 in your textbook. Which statement relative to the operation of this valve is false?

1. The upper poppet is controlled by the inside cam
2. Fluid flow to the return line is controlled by the lower poppet
3. Fluid flow from the pressure line is controlled by the upper poppet
4. The lower poppet is unseated by the outside cam to allow the fluid to flow into the cylinder and actuate the piston

3-46. When the pilot chamber of the three-way, poppet-type, normally closed directional control valve is pressurized, fluid flows from the actuating cylinder through the valve and out the exhaust port .

1. True
2. False

3-47. Which four-way valves are actuated by cams?

1. Rotary spool
2. Poppet
3. Sliding spool
4. All of the above

3-48. Which type of valve is considered most trouble free of all four-way valves?

1. Poppet
2. Rotary spool
3. Sliding spool
4. Cam operated

3-49. Which of the following represents the flow of fluid as illustrated in figure 6-34, view B in your textbook?

1. P → sleeve → C1; C2 → sleeve → R
2. P → sleeve → C2; C1 → sleeve → R
3. R → sleeve → C2; C1 → sleeve → P
4. R → sleeve → C1; C2 → sleeve → P

Learning Objective: Recognize required characteristics, functions, types, and materials of sealing devices used in fluid power systems.

3-50. Suitable packing devices for fluid power systems are made from materials that possess which of the following characteristics?

1. Compatibility with fluids used in the systems
2. Effective sealing ability
3. Durability
4. All of the above

3-51. The term “sealing devices” is a classification applicable to packing materials used to provide an effective seal between which of the following parts?

1. Two moving parts
2. Two stationary parts
3. A moving part and a stationary part
4. All of the above parts combinations

3-52. No internal leakage should be allowed to occur within a hydraulic power system because of the resulting loss in system efficiency.

1. True
2. False

3-53. Which of the following factors is/are used in determining the material used as a sealing device for a particular application?

1. Location of the seal
2. Storage of the seal
3. Both 1 and 2 above
4. Type of motion

3-54. Cork is suitable for use as gaskets because of which of the following characteristics?

1. Its resiliency
2. Its flexibility
3. Its compressibility
4. All of the above

3-55. You are reassembling a vital component which uses a copper sealing ring and discover there is not a new replacement ring. Which, if any, of the following steps should you take?

1. Reinstall the old ring after inspecting it for damage
2. Install an O-ring that is compatible with the fluid used in the system
3. Reinstall the old ring after it has been annealed
4. None of the above

3-56. Although it has many of the characteristics required in an effective seal , which of the following materials is not used as packing material in a system in which petroleum-base fluid is used?

1. Cork
2. Asbestos
3. Natural rubber
4. Synthetic rubber

Learning Objective: Recognize functions, identification procedures, inspection and installation techniques, and characteristics of various types of seals.

3-57. Which of the following statements is NOT true of T-seals?

1. T-seals provide a positive seal at low pressure
2. There is no military standard part numbering system to identify T-seals
3. The dash (-) numbers used to identify the size of T-seals are part of a preliminary numbering system
4. The Navy has created a numbering system to identify T-seals for hydraulic actuators

3-50. To obtain the correct squeeze or clearance on V-ring packing, shims or spacers are used to adjust the packing gland depth.

1. True
2. False

3-59. Regardless of its condition, an O-ring must be discarded if it cannot be positively identified.

1. True
2. False

3-60. Which of the following items can be used to identify replacement O-rings?

1. Allowance parts lists (APLs)
2. Technical manuals
3. System drawings
4. All of the above

3-61. What is the basis for computing the age of an O-ring’?

1. Service life
2. The cure date
3. Replacement schedule
4. Operational conditions

3-62. What is the expiration date of an O-ring which was cured on 13 July 1990 and has a 4-year shelf life?

1. 30 September 1994
2. 31 August 1994
3. 31 July 1994
4. 13 July 1994

3-63. Which of the following materials should NOT be used to fabricate tools for use in removing and installing O-ring and backup rings?

1. Wood
2. Steel
3. Brass
4. Phenolic rod

3-64. Why are O-rings sometimes rolled on a cone or dowel?

1. To expose the manufacturer’s identification code
2. To expose and stretch the inner diameter surface for inspection
3. To determine their breaking point
4. To condition them before installation

3-65. What is the first step in replacing an O-ring in a disassembled fluid power system component?

1. Identify the ring's size and material
2. Inspect the ring for cuts, nicks, and flaws
3. Install felt washers on both sides of the ring
4. Lubricate the O-ring groove and all surfaces over which the ring must slide

3-66. What is/are used when the O-ring installation requires spanning or inserting through sharp threaded areas, ridges, slots, and edges?

1. O-ring expanders
2. O-ring entering sleeves
3. A rolling motion of the O-ring
4. A light coating of the threads with MIL-S-8802

3-67. What device is used to prevent O-ring seal extrusion under pressure?

1. Backup ring
2. Cup packing
3. Flange packing
4. Gasket

3-68. Backup rings made from which of the following materials are the most widely used?

1. Cork
2. Leather
3. Tetrafluorethylene (TFE)
4. Bakelite

3-69. What is the age of deterioration of TFE backup rings?

1. 1 year
2. 3 years
3. 5 years
4. TFE does not deteriorate

3-70. When the packing in a fluid power system component is being replaced, the backup washers should be inspected for which of the following conditions?

1. Fray
2. cuts
3. Evidence of compression damage
4. All of the above

3-71. Which of the following statements about a Quad-Ring is false?

1. It can be used at extremely high pressures
2. It provides a seal in only one direction
3. It eliminates the spiral twist sometimes encountered with O-rings
4. It can be used as a static seal as well as a packing for reciprocating or rotary motion

3-72. Which of the following statements is incorrect concerning U-cups and U-packings?

1. They are usually made of different materials
2. They both seal on the OD and the ID
3. They are interchangeable
4. They have cross sections resembling the letter U

3-73. What type of seal is least desirable and is used only where there is not sufficient space for a U-ring packing or a V-ring packing?

1. Cup
2. Flange
3. O-ring
4. Quad-Ring

3-74. How are O-rings stored?

1. They are hung from pegs
2. They are kept under tension
3. They are kept in their original envelopes
4. They are kept in a light, moist atmosphere with a strong draft

3-75. A torn O-ring package is properly secured with which of the following materials?

1. Staples
2. Moistureproof glue
3. Outer covering of moistureproof paper
4. Pressure-sensitive, moistureproof tape

Assignment 4

Textbook Assignment: "Measurement and Pressure Control Devices," Chapter 8: "Reservoirs, Strainers, Filters, and Accumulators," chapter 9; and "Actuators," chapter 10.

Learning Objective: Recognize the construction, operational characteristics, and uses of different types of fluid pressure indicators, thermometers, and control switches.

4-1. The pressure sensing elements of Bourdon-tube gauges are commonly made in which of the following shapes?

1. The letter C
2. Helical
3. Spiral
4. All of the above

4-2. Which, if any, of the following statements correctly explains the action of a C-shaped Bourdon tube?

1. Centrifugal force of fluid flowing through the curved tube causes it to straighten out
2. Pressure applied to the tube causes its cross section to become more circular, causing It to straighten out
3. Pressure applied to the tube causes its cross section to become more circular, causing it to contract
4. None of the above

4-3. A duplex Bourdon gauge is composed of

1. one indicator dependent upon both of two separate mechanisms
2. two separate and independent mechanisms and indicators
3. one mechanism with one indicator showing current pressure and a second indicator showing the maximum pressure reached
4. one mechanism with one indicator showing pressure in pounds per square inch (psi) and a second indicator showing the load on a ram in tons

4-4. A Bourdon-tube differential pressure gauge is composed of

1. one indicator dependent upon both of two separate mechanisms
2. two separate and independent mechanisms and indicators
3. one mechanism with one indicator showing current pressure and the second indicator showing the maximum pressure reached
4. one mechanism with one indicator which can register pressure either above or below atmospheric pressure

4-5. Which of the following gauges can be used to measure the differential pressure across a strainer?

1. Duplex gauge
2. Differential pressure gauge
3. Both 1 and 2 above
4. Compound gauge

4-6. Which of the following statements describes hydraulic pressure gauges?

1. The tube is designed for hydraulic fluids only
2. The gauge is designed to operate at higher pressures
3. Some gauges are designed with a special type of spring-loaded linkage to prevent damage
4. All of the above

4-7. Gauges having bellows elements are used only for pressure indicating.

1. True
2. False

4-8. Which of the following is NOT a function of pressure switches?

1. Indicating pressure
2. Energizing an auxiliary control system
3. De-energizing an auxiliary control system
4. Signaling a visual warning or audible alarm when a preset pressure is reached

4-9. The pressure switch sensing element operates on the same principle as the Bourdon-tube pressure gauge.

1. True
2. False

4-10. A change in which of the following properties is the basis of operation of the bimetallic thermometer?

1. Chemical
2. Electrical
3. Physical
4. All of the above

4-11. What is the maximum length, in feet, of the capillary tube of distant-reading thermometers?

1. 50
2. 75
3. 100
4. 125

4-12. Distant-reading thermometers operate similarly to Bourdon-tube pressure gauges.

1. True
2. False

4-13. In the operation of pressure gauges within a hydraulic system, what does a gauge snubber do?

1. Dampens out system pressure surges and oscillations to the gauge, thereby preventing internal damage
2. Prevents hydraulic pressure indicators from oscillating, thereby ensuring an accurate system pressure reading
3. Both 1 and 2 above
4. Meters the flow of pressurized hydraulic fluid from the gauge or transmitter, thereby preventing internal damage

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Learning Objective: Recognize functions, operating requirements and characteristics, and construction features of hydraulic reservoirs and the functions of related components.

4-14. The reservoir serves the primary function of storing the hydraulic fluid required by the system, Which of the following secondary functions does it also serve?

1. Separates air from the system
2. Dissipates heat
3. Traps foreign matter
4. All of the above

4-15. The baffles In a reservoir serve which of the following functions?

1. Dissipate heat
2. Trap foreign matter
3. Separate air form the system
4. All of the above

4-16. Which of the following factors must be considered In determining the reservoir capacity of a hydraulic system?

1. The thermal expansion of the fluid
2. Whether the system is fixed or mobile
3. The volume of fluid required by the system
4. All of the above

4-17. Why must the reservoir of an aircraft designed for high-altitude operations be pressurized?

1. To maintain a net positive suction head to the pump
2. To use atmospheric pressure to assist fluid flow
3. To prevent the fluid from congealing at high altitudes
4. To vent the system during periods of high fluid demand

4-18. A pressurized reservoir may be Instead at a level below the pump suction and still maintain a positive flow of fluid to the pump.

1. True
2. False

Learning Objective: Identify operating principles and applications of accumulators.

4-19. Hydraulic systems are equipped with one or more accumulators that serve to perform which of the following functions?

1. To provide pressure for emergency operation of the system in the event of system failure
2. To act as a buffer and absorb surges and shock pressures that might damage pipes and other components of the system
3. To equalize and readjust for any pressure losses in the system due to small leaks and thermal reaction of the fluid
4. All of the above

4-20. Which of the following statements best describe(s) the advantage a vented tailrod accumulator has over a floating piston accumulator?

1. The tailrod allows the accumulator to be used as a hydraulic actuator, thus eliminating the number of system components requiring maintenance
2. The vented tailrod accumulator has the space between the piston seals vented to the atmosphere, causing air or oil leakage past the seals to be apparent
3. Both 1 and 2 above
4. The vented tailrod accumulator has a gauge that provides a quick indication of the amount of fluid in the accumulator

4-21 Why does a bladder-type, air-operated accumulator have a very high volumetric efficiency?

1. The bladder is larger at the bottom and the rubber is thinner at the top
2. The bladder is larger at the top and the rubber is thinner at the bottom’
3. The bladder is larger at the top and the rubber is thinner at the top
4. The bladder is larger at the bottom and the rubber is thinner at the bottom

4-22. Which of the following statements describe(s) how an excessive amount of gas is prevented from being entrained In direct-contact accumulators?

1. Safety fluids are used in this type of accumulator
2. The fluid port is located at the bottom of the accumulator
3. These accumulators are generally not used for pressures over 1200 psi
4. All of the above

4-23. Both the bladder-type accumulator and the diaphragm accumulator operate in a similar manner.

1. True
2. False

Learning Objective: Recognize the effects of foreign matter on filtration in a hydraulic power system Recall the functions, construction features, and operating characteristic of filters, strainers, and dehydrators.

4-24. A filter should be used to remove large particles of foreign matter from the fluid in a hydraulic power system.

1. True
2. False

4-25. To prevent the higher differential pressure that is generated at cold temperatures by high fluid viscosity from causing a false indication of a loaded filter element, what device is installed in the button-type pressure differential indicator?

1. Thermal lockout
2. Viscosity sensor
3. Collapsible filter element
4. Pressure-operated bypass valve

4-26. Nonbypassing filters are used in a hydraulic system to serve which of the following functions?

1. Decrease the frequency of flushing the system
2. Reduce the probability of the failure of other system components
3. Reduce the circulation of contaminated fluid in the system
4. All of the above

4-27. How is the bypass valve, located within the head assembly of some filters, operated?

1. Manually
2. Pressure
3. Electrically
4. Magnetically

4-28. When you find a filter differential pressure indicator button extended, what is the first action you should take?

1. Replace the indicator
2. Replace the filter el
3. Replace the filter assembly
4. Verify that the releace of the button is due to a loaded filter element

4-29. The recirculation of fluid through a proportional-flow filter over a period of time will eventually accomplish the same purpose as passage of the fluid once through a full flow filter.

1. True
2. False

4-30. The diameter, in microns, of the largest spherical particle that will pass through a filter under a certain test condition defines what filtration rating?

1. Mean
2. Nominal
3. Absolute
4. Adequate

4-31. Which of the following types of filter elements would most likely be found in the air intake of a compressor?

1. Ceramic
2. Porous metal
3. Woven screen wire
4. Moving mechanical device

4-32. Some pneumatic systems use chemical driers to remove any moisture that might collect in the lines beyond the water separators. The driers remove this moisture by what process?

1. Absorption
2. Condensation
3. Evaporation
4. Precipitation

4-33. The chemical driers referred to in the preceding question may be identified by which of the following terms?

1. Air driers
2. Desiccators
3. Dehumidifiers
4. Each of the above

Learning Objective: Recognize the types of fluid power actuating devices and identify construction features, uses, and operating characteristics of various types of actuating cylinders.

4-34. What component of a fluid power system converts fluid power into mechanical force and motion?

1. Pump
2. Valve
3. Actuator
4. Solenoid

4-35. What actuating devices are commonly used in fluid power systems?

1. Turbines
2. Motors
3. Cylinders
4. All of the above

4-36. A cylinder is identified as a ram type if its

1. piston rod diameter is less than one-half of the diameter of the piston
2. piston rod area is less than On-half the area of it
3. area is more than one-half of the area of the piston rod
4. piston rod cross-sectional area exceeds one-half of the cross-sectional area of the piston

4-37. Ram-type sinqle-acting cylinders are designed for which type of functions?

1. Push functions where springs assist the functions
2. Pull functions where springs assist the functions
3. Push functions where return action depends on springs or gravity
4. Pull functions where return action depends on springs or gravity

4-38. Four-way control valves are normally used to control the actions of the

1. single–acting ram
2. double-acting ram
3. sinqle-acting ram through two ports
4. double–acting ram using equal pressure on all valve surfaces

4-39. Refer to figure 10-2 of your textbook. Why does the extension stroke exert a greater force than the retraction stroke?

1. The pressure is much greater for the extension stroke
2. The bottom of the ram has a larger surface area than the lip
3. Both pressure and surface area are greater for the extension stroke
4. The extension stroke is usually assisted by gravity

IN QUESTIONS 4-40 THROUGH 4-42 SELECT FROM COLUMN B AN APPLICATON OF EACH TYPE OF ACTUATING CYLINDER LISTED IN COLUMN A.

A. CYLINDER TYPES	B. APPLICATIONS
4-40. Sinqle–acting. spring-loaded piston	1. Dump trucks
4-41. Telescoping ram	2. Ships' steer. ing systems
4-42. Dual ram	3. Anchor wind- lass
	4. Carrier air- craft arrest- ing hooks

4-43. The piston-type cylinder has a cross-sectional area that measures more than twice the cross-sectional area of its piston rod.

1. True
2. False

4-44. Refer to figure 10-5 in your textbook. Which statement relative to the operation of this cylinder is correct?

1. Fluid pressure extends and returns the rod
2. Fluid pressure extends the rod and gravity returns it
3. Mechanical force extends the rod and fluid pressure returns it
4. Fluid pressure extends the rod and mechanical force returns it

4-45. What type of directional control valve is normally used to control a single-acting, spring-loaded, piston-type actuating cylinder?

1. Shuttle
2. Transfer
3. Three-way
4. Four-way

4-46. Refer to figure 10-6 of your textbook. This type of cylinder is normally installed so that the greater load is carried as the piston travels in which direction?

1. To the right
2. To the left
3. To either the right or left: it does not matter since the same pressure is applied to both sides of the piston

4-47. Refer to figures 10-6 and 10-8 in your textbook. A double-acting unbalanced cylinder differs from a double-acting balanced cylinder in that the balanced cylinder has

1. equal, opposing piston surfaces
2. unequal piston rod areas
3. unequal piston surface areas
4. springs to equalize pressures on the piston

4-48. Rotary actuation of fluid power equipment can be done only with the use of fluid power motors.

1. True
2. False

4-49. Although pumps and fluid power motors are similar in design and construction, the function of each is the direct opposite to that of the other.

1. True
2. False

4-50. Which of the following operational conditions are provided by a fixed-displacement fluid motor?

1. Variable torque and constant speed
2. Constant torque and constant speed
3. Constant torque and variable speed
4. Variable torque and variable speed

4-51. In a system requiring rotation of a motor in one direction, fluid flow to the motor can be controlled by which of the following components?

1. A flow control valve
2. A variable-displacement pump
3. A two-way directional cantrol valve
4. Each of the above

4-52. Although hydraulic systems use all of the following types of fluid power motors, pneumatic systems are limited to using which type?

1. Vane
2. Gear
3. Radial piston
4. Axial piston

4-53. Refer to figure 10-12 in your textbook. Which statement about the gears is true?

1. Both 1 and 2 are driving gears
2. Both 1 and 2 are driven gears
3. 1 is the driven gear and 2 is the driving gear
4. 1 is the driving gear and 2 is the driven gear

4-54. Which of the following statements concerning the operation of the vane-type motor illustrated in figure 10-13 of your textbook is false?

1. The rotor turns because area A is greater than area B
2. The pressure of the driving force is equal in all directions
3. When the rotor turns clockwise, the vanes tend to bend backward due to centrifugal force
4. The potential energy of the driving force is converted into kinetic energy in the form of rotary motion and force

4-55. Piston-type motors and variable-displacement pumps are often combined to form a hydraulic transmission. The advantages of such a transmission over a mechanical transmission include which of the following?

1. Smooth acceleration and deceleration
2. Shock load effect reduction
3. Smooth operating action
4. All of the above

REFER TO FIGURE 10-16 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 4-56 THROUGH 4-58.

4-56. The direction of the hydraulic motor is controlled by which of the following components?

1. Electric motor
2. Hydraulic pump
3. Prime mover
4. B-end

4-57. Which of the following statements concerning the design of the hydraulic transmission illustrated in figure 10-16 of your textbook is true?

1. The A-end is a variable-displacement axial-piston motor, and the B-end is a fixed-displacement axial-piston pump
2. The A-end is a fixed-displacement axial-piston pump, and the B-end is a variable-displacement axial-piston motor
3. The A-end is a variable-displacement axial-piston pump, and the B-end is a fixed-displacement axial-piston motor
4. The A-end is a fixed-displacement axial-piston motor, and the B-end is a variable displacement axial-piston pump

4-58. The B-end of the speed gear is a fixed-displacement motor whose pistons make a full stroke for every revolution of the output shaft

1. True
2. False

Learning Objective: Identify functions, operating characteristics, and construction features of various types of turbines.

4-59. Which of the following is NOT a use of turbines?

1. Convert kinetic energy of gas to mechanical energy
2. Supply fluid flow in hydraulic systems
3. Drive electric generators
4. Drive pumps

4-60. Which of the following turbine parts convert(s) kinetic energy to mechanical energy?

1. Blade
2. Nozzle
3. Both 1 and 2 above
4. Rotor

4-61. Which of the following forces causes the reaction turbine to rotate?

1. Reactive force produced on the moving blades as the gas increases in velocity
2. Reactive force produced on the moving blades as the gas changes direction
3. The impulse of the gas impinging upon the moving blades
4. Each of the above

4-62. The nozzles of a reaction turbine are mounted between the blades.

1. True
2. False

Assignment 5

Textbook Assignment: "Pneumatics," chapter 11; "Basic Diagrams and Systems," chapter 12; chapters 9 and 10.

Learning Objective: Recall facts pertaining to the development of gases and the characteristics of gases.

5-1. Pneumatic power is most commonly used in complex systems.

1. True
2. False

5-2 Which of the following characteristics is/are true for gases?

1. They have no definite volume
2. They have no definite shape
3. Gases are lighter than equal volumes of liquids
4. All of the above

Learning Objective: Relate the common temperature scales by converting temperature readings between them.

IN ANSWERING QUESTIONS 5-3 THROUGH 5-6, SELECT FROM COLUMN B THE TEMPERATURE THAT CORRESPONDS TO THE ABSOLUTE ZERO TEMPERATURE FOR EACH OF THE SCALES IN COLUMN A.

	A. SCALES	B. TEMPERATURES
5-3.	Celsius	1. -460°
		2. -273°
5-4.	Fahrenheit	
5-5.	Kelvin	3. 0°
5-6.	Rankine	

5-7. Which of the followig statements is true concerning absolute zero?

1. It is the temperature at which no heat remains in a gas but not the lowest temperature obtainable
2. It was attained only once, at which time the absolute zero point of -273.16°C was determined
3. It is the temperature at which all molecular activity in a substance ceases
4. It is the temperature to which liquids, solids, and gases can be reduced and at which most molecular activity ceases

IN ANSWERING QUESTIONS 1-8 THROUGH 5-12 REFER TO FIGURE 11-1 IN YOUR TEXTBOOK.

5-8. What is the Celsius scale equivalent of 68°F?

1. 5.7°C
2. 20.0°C
3. 37.7°C
4. 52.0°C

5-9. What is the Kelvin scale equivalent of 68°F?

1. 253°K
2. 273°K
3. 293°K
4. 341°K

5-10. What is the Rankine scale equivalent of 68°F?

1. 341°R
2. 441°R
3. 460°R
4. 528°R

5-11. What Is the Celsius scale equivalent of 263°K?

1. 90°C
2. 10°C
3. 0°c
4. -10°C

5-12. What is the Fahrenheit scale equivalent of 263°K?

1. -l8°F
2. -14°F
3. 14°F
4. 18°F

Learning Objective: Recognize the pressure characteristics of gases and liquids, including how pressure is caused by the weight of the atmosphere, and identify how pressures are measured.

5-13. Gases exert equal pressure on all surface areas of their containers.

1. True
2. False

5-14. When a reading is taken of the pressure in an automobile tire, what does the gauge reading represent?

1. Local atmospheric pressure plus the absolute pressure
2. Absolute pressure minus the local atmospheric pressure
3. Local atmospheric pressure minus the absolute pressure
4. Absolute pressure

5-15. What is the absolute pressure (psia) in a cylinder that has a gauge reading of 1990 psig?

1. 1843
2. 1975.3
3. 2004.7
4. 2137

5-16. What is the gauge pressure (psig) of a container that has an internal pressure of 113 psia?

1. 98.3
2. 99.7
3. 125.3
4. 127.7

5-17 Whenever you apply the gas laws, you must use absolute pressure.

1. True
2. False

Learning Objective: Identify various theories, laws, and properties of gases, correlate these with applicable formulas, and solve related problems.

5-18 When you observe that the pressure of gas in a sealed container has increased, you can assume that

1. heat has been absorbed by the gas
2. heat has been removed from the gas
3. the kinetic energy of the gas has decreased
4. molecules of the gas gained energy from each other while colliding

5-19. Four cubic feet of nitrogen are under a pressure of 50 psig. If the nitrogen is compressed to 2 cubic feet, what is the new gauge pressure?

1. 104 psig
2. 114.7 psig
3. 124 psig
4. 134 psig

5-20. A cylinder of gas at 75°F has a pressure of 900 psig, To what maximum temperature may it be heated without exceeding 1000 psig?

1. 211.9°F
2. 174.9°F
3. 158.4°F
4. 133.4°F

5-21. The general gas equation used in the study of gases is a combination of the gas laws of

1. Charles and Boyle
2. Charles and Kelvin
3. Boyle and Fahrenheit
4. Boyle, Charles, and Kelvin

5-22. Four cubic feet of a gas at 40°F has a gauge pressure of 100 psig. If the volume of the gas is expanded to 6 cubic feet and the gas heated to a temperature of 90°F, what will the new gauge pressure be?

1. 67.9 psig
2. 69.4 psig
3. 71.5 psig
4. 73.6 psig

Learning Objective: Recognize characteristics of gases used in pneumatic systems, safety precautions for handling compressed gas, and color codes of compressed gas cylinders.

5-23. In addition to being nonpoisonous and free from any acids that might cause system corrosion, the gas used as the fluid medium for a pneumatic system must possess which of the following characteristics?

1. Nonflammability
2. Chemical stability
3. Ready availability
4. All of the above

5-24. The gases used in Navy pneumatic systems are similar to the liquids used in hydraulic systems, except that the gases are not

1. acid free
2. nontoxic
3. good lubricants
4. chemically stable

5-25. What characteristic of compressed air makes it undesirable as a medium for pneumatic systems?

1. Its toxicity
2. Its flammability
3. Its moisture content
4. Its lubricating qualities

5-26. In all compressed air systems, the compressor, due to the unlimited supply of air, is installed in the distribution lines leading to the device to be operated.

1. True
2. False

5-27. Which of the following statements is NOT true of LP air systems?

1. The LP air system is supplied with LP air by LP air compressors
2. The LP air system is supplied with air by the HP air system supplying air through a pressure-reducing station
3. The LP air system is supplied with air by the MP air system supplying air through a pressure-reducing station
4. LP compressed air is used in the production of nitrogen

5-28. Why is the use of nitrogen preferred over the use of compressed air in many aircraft and missile pneumatic systems?

1. Nitrogen cannot support living organisms
2. Nitrogen cannot support combustion and fire
3. Nitrogen does not cause rust or decay of the surfaces with which it comes in contact
4. All of the above

5-29. Which of the following steps can a maintenance person take to control contamination of pneumatic systems?

1. Install an air filter in the supply line
2. Keep all tools and the work air clean and dirt free
3. Cap or plug all lines and fittings immediately after disconnecting them
4. Both 2 and 3 above

5-30. You must NEVER use the contents of a cylinder identified by which of the following color codes for purging an oxygen system?

1. Gray
2. Black
3. One black stripe around its top
4. One green stripe around its top

5-31. Inasmuch as compressed air is neither toxic nor flammable, the ordinary precautions for handling compressed gases do not apply to handling it.

1. True
2. False

5-32. Inasmuch as nitrogen is nontoxic, the usual ventilation precautions need not be observed when nitrogen is used in confined spaces.

1. True
2. False

5-33. Which, if any, of the following operations is an acceptable practice during the use of compressed gases?

1. Perform general space cleanup
2. Tighten leaking portions of compressed gas systems while they are pressurized to ensure that you stop the leak
3. Pressurize empty lines and vessels rapidly
4. None of the above

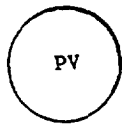
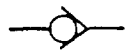
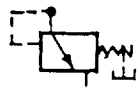
Learning Objective: Recognize the importance of diagrams and symbols, identify symbols used in diagrams, and types of diagrams.

5-34. For a mechanic or technician. which of the following aids is/are provided by diagrams?

1. Location of components within a system
2. Location of general components
3. Understanding of how a system operates
4. All of the above

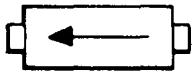
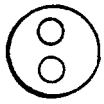
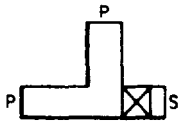
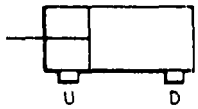
REFER TO APPENDIX II OF YOUR TEXTBOOK IN ANSWERING QUESTIONS 5-35 THROUGH 5-3B.

FOR QUESTIONS 5-35 THROUGH 5-38, SELECT FROM COLUMN B THE MECHANICAL SYMBOL FOR EACH HYDRAULIC SYSTEM COMPONENT LISTED IN COLUMN A.

	A COMPONENTS	B SYMBOLS
5-35.	Sequence valve	1. 
5-36.	Variable displacement pump	
5-37.	Check Valve	2. 
5-38.	Pressure gauge	3.
		4. 

REFER TO APPENDIX III OF YOUR TEXTBOOK IN ANSWERING QUESTIONS 5-39 through 5-41.

FOR QUESTIONS 5-35 THROUGH 5-41, SELECT FROM COLUMN B THE AERONAUTICAL MECHANICAL SYMBOL FOR EACH HYDRAULIC SYSTEM COMPONENT LISTED IN COLUMN.

	A. COMPONENTS	B. SYMBOLS
5-39.	Power-driven pump	1. 
5-40.	Actuating cylinder	2. 
5-41.	Automatic check valve	3. 
		4. 

FOR. QUESTIONS 5-42 THROUGH 5-45, SELECT FROM COLUMN B THE DIAGRAM THAT IS DEFINED IN COLUMN A.

	A. DEFINITIONS	B. DIAGRAMS
5-42.	Shows the internal parts of the components	1. Combination
		2. Pictorial
5-43.	Shows the general location of components	3. Graphic
		4. Cutaway
5-44.	Uses symbols, shows actual appearance, and shows internal working part	
5-45.	Uses symbols to show components	

5-46. Which of the following diagrams includes the interconnecting system piping?

1. Combination
2. Pictorial
3. Graphic
4. Each of the above

5-47. Which, if any, of the following diagrams contains pipe sizes and data on the sequence of system operation?

1. Combination
2. Pictorial
3. Graphic
4. None of the above

5-48. A schematic diagram of a hydraulic system enables a mechanic to accomplish which of the following tasks?

1. Understand the operation of the system
2. Identify components of the system
3. Trace the flow of fluid through the system
4. All of the above

5-49. Which of the following statements about an oper-center hydraulic system is false?

1. The directional control valves are connected in parallel
2. There is no pressure in the system when the actuators are idle
3. The system may have any number of subsystems with a directional control valves, for each
4. The pump circulates fluid from the reservoir, through the directional control valves, and back to the reservoir

5-50. Why are closed-center hydraulic systems the most widely used systems.?

1. They provide smooth operation of their actuators
2. They eliminate continuous system pressurization
3. They operate very rapidly
4. They do all of the above

Learning Objective: Recognize Navy applications, component functions. construction features, and operating characteristics of hydraulic power drive systems.

5-51. Hydraulic power drives are used in the Navy to perform which of the following functions?

1. Drive and control winches, capstans , and windlasses
2. Train and elevate nearly all calibers of guns
3. Position rocket and missile launchers
4. All of the above

QUESTIONS 5-52 THROUGH 5-55, SELECT FROM COLUMN B THE HYDRAULIC POWER DRIVE SYSTEM COMPONENT TO WHICH EACH STATEMENT IN COLUMN A APPLIES.

	A. STATEMENTS	B. COMPONENTS
5-52.	It can be an electric motor	1. A- end
5-53.	It is a hydraulic motor mover	2. B-end
5-54.	It is a hydraulic pump	3. Prime
5-55.	It can be a gasoline enigine	

REFER TO FIGURE 12-5 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 5-56 THROUGH 5-62.

5-56. The forward shaft of the prime mover drives which of the following components?

1. The hydraulic pump
2. The hydraulic motor
3. The auxiliary pumps
4. All of the above

5-57. What type of pump is the A-end pump of this power drive?

1. Axial-flow variable-displacement
2. Radial-flow variable-displacement
3. Axial-flow constant-displacement
4. Radial-flow constant-displacement

5-58. Which of the following statements is true concerning the operation of the A-end?

1. Its output is variable because it is driven at a variable speed
2. Its output is constant because it is driven at a constant speed
3. Its output is variable even though it is driven at a constant speed
4. Its output is constant even though it is driven at a variable speed

IN QUESTIONS 5-59 THROUGH 5-62, SELECT FROM COLUMN B THE AUXILIARY PUMP THAT PERFORMS EACH FUNCTION LISTED IN COLUMN A.

	A. FUNCTIONS	B. PUMPS
5-59.	Transmits a pulsing effect to the fluid in the response pressure	1. Replenishing
5-60.	Replaces fluid in the active systems of the power drive	2. sump pump and oscillator
5-61.	Supplies high-pressure fluid to the various pistons in the system	3. Control pres sure
5-62.	Pumps leakage to the expansion tank	

5-63. What function(s) does the reservoir provide?

1. A method of cleansing and storing fluid
2. A reserve supply of fluid
3. A cooling surface for the fluid
4. Both 2 and 3 above

REFER TO FIGURE 12-6 IN YOUR TEXTBOOK IN AWSWERING QUESTIONS 5-64 AND 5-65.

5-64. How is the tilting box positioned?

1. Locally by the stroke control shaft
2. Automatically by the stroke control shaft
3. Mechanically by hand control
4. By each of the above means

5-65. The tilting box will not move under which of the conditions listed below?

1. IHP = 385 psi, HPC = 900 psi
2. IHP = 500 psi, HPC = 1000 psi
3. IHP = 750 psi, HPC = 750 psi
4. IHP = 800 psi, HPC = 1000 psi

5-66. The direction and speed of the hydraulic motor are controlled by the

1. electric motor
2. hydraulic pump
3. prime mover
4. B-end

REFER TO FIGURE 12-8 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 5-67 THROUGH 5-71.

5-67. Which of the following components is/are NOT operated by nitrogen from the manually operated nitrogen bottle?

1. Dump valves
2. Nose gear cylinder
3. Main gear unlock cylinders
4. Aft door cylinders

5-68. What provides the force to reposition the shuttle valves for emergency operation?

1. Hydraulic fluid
2. Gravity
3. Springs
4. Nitrogen

5-69. When the emergency system is actuated, what force extends the main gear after the unlock hooks are released?

1. Gravity
2. Hydraulic pressure
3. Nitrogen pressure
4. A combination of gravity and nitrogen pressure

5-70. When the emergency system is actuated, what component is used in the system to prevent a fluid lock in the landing gear?

1. Dump valve
2. Timer valve
3. Relief valve
4. Shuttle valve

REFER TO FIGURE 12-10 IN YOUR TEXTBOOK IN ANSWERING QUESTIONS 5-71 AND 5-72.

5-71. How is the main valve in the 4-way valve assembly normally operated?

1. Electrically
2. Hydraulically
3. Manually

5-72. What is the function of the orifice plate installed in the lines to port A of the hydraulic cylinders?

1. To control the flow of hydraulic fluid to the cylinder for raising operations
2. To control the flow of hydraulic fluid to the cylinder for lowring operations
3. Both 1 and 2 above
4. To allow for changes in the viscosity of the hydraulic flluid as its temperature changes

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