Lakeshore Technical College

10-620-104 Fluid Power II

Course Outcome Summary

Course Information

Description This is a continuation of the introductory course Fluid Power 1. Topics covered are an in-depth study of symbols and graphic diagrams, properties of hydraulics and pneumatics (Fluids), and advanced circuits. Theory of regenerative circuits, accumulators, and pressure control valves will be studied and applied to simulated industrial hydraulic circuits. The final unit will combine all information studied in both Fluid Power 1 and Fluid Power 2 courses and apply it to troubleshooting of real world problems.

Total Credits 3

Total Hours 64

Pre/Corequisites

Prerequisite Successful completion of 620-103 Fluid Power 1 with a minimum grade of "C"

Prerequisite Successful completion of Intermediate Algebra with a minimum grade of “C” or Instructor approval

Course Competencies

1. Evaluate industrial air systems, equipment, and air quality

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Use mathematics effectively

Assessment Strategies

1.1. Written Objective Test
1.2. Performance
1.3. Project

Criteria

1.1. Your performance will be satisfactory when you can identify the pars of an industrial air system
1.2. Your performance will be successful when you use the proper formulas to calculate the size of compressor and receiver
1.3. Your performance will be successful when you can apply the proper formulas to calculate flow and pressure drop

Learning Objectives

1.a. Identify parts of a pneumatic system
1.b. Calculate the size of compressor required in CFM and identify the Hp required

1.c. Calculate the size of receiver tank required
1.d. Calculate the velocity of air flow through piping
1.e. Describe the relationship between pressure drop and flow
1.f. Relate and select the appropriate equipment for a facilities air

2. Interpret schematics containing hydraulic component symbols

Linked Core Abilities

Apply learning
Communicate effectively

Assessment Strategies

2.1. Performance
2.2. Written Objective Test

Criteria

2.1. Your performance will be successful when you can properly match the components on a drawing with components on an industrial air system.
2.2. Your performance will be successful when you can construct a hydraulic system from a drawing

Learning Objectives

2.a. Identify industry standardized colors to correct function
2.b. Identify components on trainer from a graphic diagram
2.c. Draw individual component symbols from a word description
2.d. Construct an operating hydraulic system from a graphic diagram of the circuit

3. Assemble a hydraulic system using a hydraulic schematic.

Linked Core Abilities

Apply learning
Demonstrate critical thinking
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

3.1. Performance
3.2. Written Objective Test

Learning Objectives

3.a. Construct a graphic diagram from a pictorial representation of a circuit
3.b. Assemble a hydraulic system
3.c. Identify hydraulic system components

4. Analyze a hydraulic systems operation by using a hydraulic schematic

Linked Core Abilities

Apply learning
Work cooperatively

Assessment Strategies

4.1. Performance
4.2. Written Objective Test

Criteria

4.1. Your performance will be satisfactory when you can draw an already constructed system

Learning Objectives

4.a. Explain the various types of diagrams used in hydraulics; such as graphic, pictorial, cutaway and combination
4.b. Identify components from a graphic diagram

5. Evaluate the general characteristics, terms, etc., of linear actuators

Linked Core Abilities

Apply learning
Demonstrate critical thinking

Assessment Strategies

5.1. Performance
5.2. Written Objective Test

Criteria

5.1. Your performance will be satisfactory when you can explain in writting the diagrams provided
5.2. Your performance will be satisfactory when you can select and use the proper formulas for the proplems provided.
5.3. Your perfromance will be acceptable when you can identify the types of cylinder mountings

Learning Objectives

5.a. Identify parts of a pneumatic cylinder
5.b. Calculate compressive load for a given cylinder
5.c. Calculate tensile load for a given cylinder
5.d. Calculate compression ratio for given cylinder
5.e. Calculate the size of a cylinder using Pascal's Law given total load and pressure values.
5.f. Define terms associated with cylinders such as: rod gland, compression load, basic length, tension load, buckling, stroke adjuster, stop tube, cushion, compression ratio, rod sag, rod end, and cap end
5.g. Explain the reason for using stop tubes in pneumatic cylinders
5.h. Explain why cushions are used on pneumatic cylinders and differentiate between spear and sleeve cushions
5.i. Describe the following cylinder mounting methods: head trunnion, flange, and side lug

6. Assemble hydraulic circuit using cylinders

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

6.1. Performance
6.2. Written Objective Test

Criteria

6.1. Your performance will be satisfactory when you can demonstrate the proper methods of attaching cylinder end caps

Learning Objectives

6.a. Identify various methods of cylinder mounting styles
6.b. Identify three methods of attaching end caps to cylinder body

7. Evaluate the general characteristics, terms, etc. of hydraulic cylinders

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

7.1. Performance
7.2. Written Objective Test

Criteria

7.1. Your performance will be satisfactory when you can describe in writing series and parallel fluid power circuits
7.2. Your performance will be satisfactory when you can design / draw both series and parallel fluid power circuits.

7.3. Your performance will be satisfactory when you can explain in writing the extension and retraction speed of a cylinder

Learning Objectives

7.a. Explain why a linear actuator takes longer to extend than to retract
7.b. Demonstrate pressure intensification in a series circuit
7.c. Accept the extension sequence of parallel cylinders having differing bore sizes.
7.d. Describe the purpose of cylinder cushioning
7.e. Describe how cylinders operate in series
7.f. Describe how cylinders operate in parallel
7.g. List three common places that cylinders have seals
7.h. Define the following terms as they relate to hydraulic cylinders; rod gland seal, ram, cap end, rod end, head end, blind end, double acting, single acting, duplex cylinder, tandem cylinder and port, i. Synchronize

8. Evaluate the general characteristics and terms of hydraulic fluids

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

8.1. Performance
8.2. Written Objective Test

Criteria

8.1. Your performance will be satisfactory when you can describe and demonstrate the effects of temperature change on fluid viscosity
8.2. Your performance will be satisfactory when you properly identify the fluid additive for a given deficiency

Learning Objectives

8.a. Accept the effect of temperature change on viscosity
8.b. Identify four requirements for a fluid in a hydraulic system
8.c. Identify quality requirements of hydraulic fluid
8.d. Define viscosity
8.e. List four additives commonly found in hydraulic oils and explain their functions
8.f. Define terms associated with fluids, such as: dash number, viscosity index, Saybolt Universal Second
8.g. Describe operating/maintenance procedures that should be followed to assure maximum oil life

9. Evaluate the general characteristics and terms of hydraulic fluid conditioning (filtering)

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

9.1. Performance
9.2. Written Objective Test

Learning Objectives

9.a. Identify type of filtration by position in a system
9.b. Describe the characteristics of depth and surface type filter elements
9.c. Define terms associated with filters, such as: nominal rating, absolute rating, micron, cavitation, aeration, by-pass valve
9.d. List sources of contamination

10. Evaluate the general characteristics and terms of hydraulic fluid conductors

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

10.1. Performance
10.2. Written Objective Test

Criteria

10.1. Your performance will be satisfactory when you can apply the proper formulas to calculate velocity in a hydraulic line

10.2. Your performance will be satisfactory when you can demonstrate how to use a nomograph to identify fluid velocity in a pipe

Learning Objectives

10.a. Identify three broad types of conductors
10.b. Describe how pipe size is classified
10.c. Explain proper installation recommendations that will avoid leaks, contamination of the system and noisy operation
10.d. Calculate velocity in a hydraulic line using a nomograph

11. Evaluate the general characteristics and terms of hydraulic reservoirs

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

11.1. Performance
11.2. Written Objective Test

Criteria

11.1. Your performance will be satisfactory when you demonstrate your understanding of the functions of a reservoir
11.2. Your performance will be satisfactory when you can describe in writting the proper design of a hydraulic reservoir

Learning Objectives

11.a. Identify parts of a reservoir
11.b. Name three possible functions of the reservoir
11.c. Describe what a reservoir baffle plate is used for

12. Evaluate the general characteristics and terms of regenerative circuits

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Use mathematics effectively
Work cooperatively

Assessment Strategies

12.1. Performance
12.2. Written Objective Test

Criteria

12.1. Your performance will be satisfactory when you can describe and demonstrate a regenerative system
12.2. Your performance will be satisfactory when you can describe both regenerative and standard hydraulic circuits

Learning Objectives

12.a. Describe the operation of a regenerative circuit
12.b. Describe the effect of regeneration on cylinder speed
12.c. Describe the effect of regeneration on cylinder force
12.d. Explain the actuator requirements for a regenerative circuit
12.e. Compare regenerative circuits with standard actuator circuits

13. Troubleshoot regenerative circuits

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

13.1. Performance
13.2. Written Objective Test

Criteria

13.1. Your performance will be satisfactory when you can demonstrate your ability to identify and resolve hydraulic problems in a regenerative circuit

Learning Objectives

13.a. Draw a schematic diagram of a regenerative circuit and trace the flow of fluid during different modes of operation
13.b. Demonstrate how a regenerative circuit operates

14. Evaluate the general characteristics and terms of hydraulic accumulators

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Use mathematics effectively
Work cooperatively

Assessment Strategies

14.1. Performance
14.2. Written Objective Test

Criteria

14.1. Your performance will be satisfactory when you can describe in writing the comparison between an accumalator in a hydraulic circuit to a capacitor in an electrical circuit.
14.2. Your performance will be satisfactory when you can demonstrate circuits using accumulators
14.3. Your performance will be satisfactory when you can explain how accumulators are used in a hydraulic circuit

Learning Objectives

14.a. Compare accumulator action in a hydraulic circuit to capacitor action within an electrical circuit
14.b. Explain the use of accumulators as energy supplies

14.c. Explain how an accumulator may be used as emergency for back-up power
14.d. Explain how an accumulator can be used to hold loads
14.e. Explain why compressed air is not used in hydro pneumatic accumulators
14.f. Summarize the safety requirements for accumulator circuits
14.g. Explain "Boyle's Law" as it pertains to gas charged accumulators
14.h. Explain how pre-charge pressure and system pressure relate to volume of oil stored in an accumulator
14.i. Identify factors that are used to rate accumulators

15. Identify general types of accumulators

Linked Core Abilities

Apply learning
Demonstrate critical thinking

Assessment Strategies

15.1. Performance
15.2. Written Objective Test

Criteria

15.1. Your performance will be satisfactory when you can list the types of accumulators, their positive and negative points.

Learning Objectives

15.a. Identify the general types of accumulators
15.b. Explain the operation of a spring-loaded accumulator
15.c. Explain the operation of a hydro pneumatic accumulator
15.d. Explain the operation of a weight-loaded accumulator
15.e. Identify various accumulator symbols

16. Evaluate the general characteristics and terms of hydraulic pressure control valves

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

16.1. Performance
16.2. Written Objective Test

Criteria

16.1. Your performance will be satisfactory when you can describe and draw the symbols of the different pressure control valves
16.2. Your performance will be satisfactory when you can identify and build circuits using the different pressure control valves

Learning Objectives

16.a. Explain how an internally drained valve differs from an externally drained valve
16.b. Explain how a pressure relief valve can be controlled remotely
16.c. Define terms associated with pressure control valves, such as: normally open, normally closed, cracking pressure, full flow pressure, pressure override, balanced valve and infinite positioning
16.d. Identify symbols for various types of pressure control valves
16.e. Identify two purposes of a pressure relief valve

17. Analyze the operation of hydraulic pressure control valves in various hydraulic circuits

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate critical thinking
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity

Use mathematics effectively
Work cooperatively

Assessment Strategies

17.1. Performance
17.2. Written Objective Test

Criteria

17.1. Your performance will be satisfactory when you can describe in writing, the operation of each pressure control valve

Learning Objectives

17.a. Describe the design and operation of a pressure relief valve
17.b. Trace the fluid flow through various valves during particular modes of operation
17.c. Describe the design and operation of a unloading valve
17.d. Describe the design and operation of a pressure reducing valve
17.e. Describe the design and operation of a sequence valve
17.f. Describe the design and operation of a counterbalance valve
17.g. Describe the design and operation of a brake valve
17.h. Test the operation of a clamp and bend circuit using a pressure reducing valve
17.i. Control the tonnage of a press cylinder remotely

18. Apply manufacture specifications to test the main components of a hydraulic system

Linked Core Abilities

Apply learning
Communicate effectively
Demonstrate responsible and professional workplace behaviors
Respect and appreciate diversity
Work cooperatively

Assessment Strategies

18.1. Performance
18.2. Written Objective Test

Criteria

18.1. Your performance will be satisfactory when you can evaluate the condition of a directional control valve.
18.2. Your performance will be satisfactory when you can demonstrate the effects of temperature on hydraulic component leakage

Learning Objectives

18.a. Show normal leakage of a directional valve
18.b. Evaluate the condition of a directional valve according to the amount of leakage flow
18.c. Verify the accuracy of a flow meter
18.d. Determine the effect of temperature on flow meter accuracy

19. Troubleshoot a malfunctioning hydraulic system

Linked Core Abilities

Apply learning
Demonstrate critical thinking
Respect and appreciate diversity
Use mathematics effectively

Assessment Strategies

19.1. Performance
19.2. Written Objective Test

Criteria

19.1. Your performance will be satisfactory when you can demonstrate troubleshooting of a hydraulic circuit
19.2. Your performance will be satisfactory when you can demonstrate tracing contamination to a source
19.3. Your performance will be satisfactory when you can interpret symptoms in a hydraulic circuit

Learning Objectives

19.a. Explain hydraulic machine operation in terms of flow and pressure

19.b. Diagnose a systems heat problem
19.c. Trace contamination problems to their source
19.d. Determine why a pump is cavitating or aerating
19.e. Interpret symptoms in a circuit which uses pressure controlled valves