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Northeast Wisconsin Technical College

10-620-100 054702 Fluids 1: Basic Pneumatics

Course Outcome Summary

Course Information

Description	10-620-100 FLUIDS 1: BASIC PNEUMATICS ...what fluid power is, differentiate between hydraulics and pneumatics, implement basic pneumatic circuits, utilize schematics, apply Pascal's Law, define properties of fluids, implement airflow control and hydraulics cylinder circuits.
Total Credits	1
Total Hours	36

Course History

Last Revision Date	12/14/2017

Learner Supplies

Safety Eyewear. **Description:** Safety Eyewear compliant with ANSI Z87.1-2003 standards. Required.

Employability Skills

1. Communicate Effectively
2. Demonstrate Personal Accountability
3. Solve Problems Effectively
4. Think Critically and Creatively
5. Value Individual Differences and Abilities
6. Work Cooperatively and Professionally

Program Outcomes

1. TSA1 - Perform work safely
2. TSA2 - Troubleshoot electrical and mechanical systems and devices
3. TSA4 - Communicate Technical Information
4. Understand and apply knowledge of electricity, electronics, hydraulics, and electric motors and mechanics.

5. Read technical drawings, schematics, and diagrams.
6. Document technical information through descriptive writing, sketches/diagrams, mathematical expression, computation, and graphs.
7. Perform electrical, mechanical, and fluid measurements by properly selecting tools and test equipment.
8. Perform electrical/mechanical assembly/disassembly, repair, or calibrate components by properly selecting tools and equipment and following procedures.
9. Understand the overall operation and control of machines.
10. Apply critical thinking skills to solving problems.
11. Perform safe work practices.

Course Competencies

1. Implement Basic Pneumatic Cylinder Circuits and Connections

Assessment Strategies

By implementing basic pneumatic cylinder circuits and connections

Learning Objectives

1.a. Explain what fluid power is
1.b. Differentiate between the terms hydraulics and pneumatics
1.c. Design a multiple cylinder pneumatic circuit

Criteria

Your performance will be successful when:

1.1. Read a pneumatic pressure gage.
1.2. Define pneumatics and describe key applications of fluid power.
1.3. Describe the functions of basic components of pneumatics system.
1.4. Specify the basic components of fluid power systems.
1.5. Define pneumatic pressure and give its units of measurement.
1.6. Describe the function of a pneumatic schematic.
1.7. Differentiate between fluid power systems and fluid transport systems.
1.8. Explain the history of the fluid power industry.
1.9. Discuss advantages and disadvantages of fluid power.
1.10. Distinguish between open-loop and closed-loop fluid power systems.
1.11. Recognize the various types of fluid power control systems.
1.12. Discuss size and scope of the fluid power industry.
1.13. Explain six pneumatic safety rules.
1.14. Describe the function of a pressure regulator valve and give an application.
1.15. Describe the operation of a pressure regulator valve and give its schematic symbol.
1.16. Describe the function of an air filter.
1.17. Describe the operation of an air filter and give its schematic symbols.
1.18. Describe the purpose, construction, and operation of compressors.
1.19. Explain the purpose and operation of fluid conditioners, including filters, regulators, lubricators, mufflers, and air dryers.
1.20. Discuss the construction and operation of pneumatic cylinders.
1.21. Connect and adjust a pressure regulator.
1.22. Drain a pneumatic filter.
1.23. Describe the function of a pneumatic quick-connect fitting and give its schematic symbol.
1.24. Describe the function of a tee and a cross and give their schematic symbols.
1.25. Connect a pneumatic hose that uses quick-connect fittings.
1.26. Use a tee to connect two circuit branches together.
1.27. Use a cross to connect three circuit branches together.
1.28. Describe the function of a pneumatic cylinder and give an application.
1.29. Describe the operation of a double-acting pneumatic cylinder and give its schematic symbol.
1.30. Describe the function of a 5-way, 3-position, DCV and give an application.

1.31. Describe the operation of a 5-way, 3-position DCV and give its schematic symbol.
1.32. Connect and operate a double-acting pneumatic cylinder using a 3-position, manually-operated DCV.

2. Implement Basic Pneumatic Actuator Circuits

Assessment Strategies

By implementing basic pneumatic actuator circuits

Learning Objectives

2.a. Describe the purpose, construction, and operation of pneumatic pressure control valves, flow control valves, and directional control valves.
2.b. Utilize Pneumatic Schematics

Criteria

Your performance will be successful when:

2.1. Describe the function of a single-acting pneumatic cylinder and give an application.
2.2.
2.3. Describe the operation of a single-acting, spring-return cylinder and give its schematic symbol.
2.4. Describe the function of a 3/2 pneumatic DCV and give an application.
2.5. Describe the operation of a 3/2 pneumatic DCV and give its schematic symbol.
2.6. Connect and operate a single-acting pneumatic cylinder using a 3/2 manually-operated DCV
2.7. Describe the function of a pneumatic motor and give an application.
2.8. Describe the operation of a pneumatic motor and give its schematic symbol.
2.9. Describe the function of a muffler and give its schematic symbol.
2.10. List three common pneumatic motor designs and explain where they are used.
2.11. Connect and operate a unidirectional pneumatic motor using a 3-way, manually-operated DCV.
2.12. Describe the line symbols used with fluid power circuits.
2.13. Describe seven basic rules for drawing pneumatic schematics.
2.14. Explain the important considerations that must be taken into account when analyzing or designing a pneumatic circuit.
2.15. Read pneumatic diagrams and describe the corresponding system operation.

3. Apply Pascal's Law and Boyles Law to Pneumatic Systems

Assessment Strategies

By applying Pascal's Law and Boyle's Law to pneumatic systems

Learning Objectives

3.a. State Pascal's Law and explain its significance in pneumatics.
3.b. Define The Fundamental Physical Properties of Fluids

Criteria

Your performance will be successful when:

3.1. Describe how to calculate the force output of an extending cylinder.
3.2. Describe how to calculate the force output of a hydraulic cylinder in retraction.
3.3. Calculate the extension force of a cylinder given its size and pressure.
3.4. Measure the force output of an extending cylinder.
3.5. Calculate the retraction force of a cylinder given its size and pressure.
3.6. Explain how force is multiplied with Pascal's Law.
3.7. Calculate the force created by a pressure.
3.8. Describe two methods of representing pressure.
3.9. Explain how air pressure is created in a pneumatic system.
3.10. State Boyle's Law and explain its significance.
3.11. Convert between gage and absolute pressure.
3.12. Apply the perfect gas laws to determine the interactions of pressure, volume, and temperature of a gas and use Boyle's Law to calculate changes in pressure and volume.
3.13. Explain how a pneumatic system creates air flow.
3.14. Describe two types of resistance in a pneumatic system.
3.15. Explain how Delta P describes pneumatic resistance and explain its importance.
3.16. Describe what determines the speed of a pneumatic actuator.
3.17. Determine and calculate pressure losses in pipelines of pneumatic circuits.
3.18. Measure Delta P across pneumatic components.

3.19. Define the term fluid.
3.20. Distinguish between a liquid and a gas.
3.21. Define the terms weight, density, and specific gravity
3.22. Understand the terms pressure, head, and force.
3.23. Homework check-off point
3.24. LAP Skill Accomplishment points
3.25. LAP Skill Accomplishment Test

4. Implement Air Flow Control and Measurement to Control Speed

Assessment Strategies

By implementing air flow control and measurement to control speed

Learning Objectives

4.a. Describe air flow control components
4.b. Describe flow control circuits

Criteria

Your performance will be successful when:

4.1. Describe the main function of a pneumatic needle valve and give an application.
4.2. Describe the operation of a needle valve and give its schematic symbol.
4.3. Define air flow rate and give its units of measurement.
4.4. Describe the function of a flowmeter and give an application.
4.5. Connect and operate a needle valve to control actuator speed.
4.6. Connect and read a flowmeter.
4.7. Describe the function of a pneumatic check valve and give an application.
4.8. Describe the operation of two types of pneumatic check valves and give their schematic symbol.
4.9. Describe the function of a flow control valve and give an application.
4.10. Describe the operation of a flow control valve and give its schematic symbol.
4.11. Describe the effect of actuator load changes on flow control operation.
4.12. Connect and operate a check valve.
4.13. Connect and adjust a flow control valve to control speed of an actuator.
4.14. Describe the operation of a meter-in flow control circuit and give an application.
4.15. Describe the operation of a meter-out flow control circuit and give an application.
4.16. Determine how the flow rate of air can be controlled by an orifice.
4.17. Connect and operate a meter-in flow control circuit.
4.18. Connect and operate a meter-out flow control circuit.
4.19. Connect and operate an exhaust port speed control circuit.
4.20. Connect and operate a pressure port speed control circuit.
4.21. Design speed control circuits.
4.22. Design an independent speed control circuit.
4.23. Describe the operation of an exhaust-port speed control and give an application.
4.24. Describe the operation of a pressure port speed control and give an application.
4.25. Define independent speed control and give an application.