

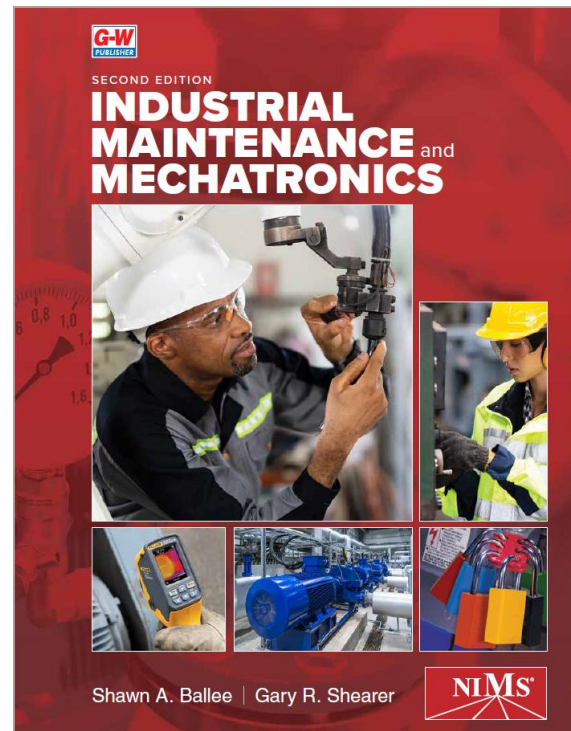


Correlation of
Industrial Maintenance and Mechatronics,
Shawn A. Ballee and Gary R. Shearer
 Goodheart-Willcox Publisher ©2024
 to
NIMS (National Institute for Metalworking Skills)
 Classic Credential:
Basic Pneumatic Systems

Industrial Maintenance and Mechatronics carries NIMS' exclusive endorsement and supports attainment of NIMS credentialing in Industrial Technology Maintenance (ITM).

The textbook is designed to work hand-in-glove with the NIMS Standards for Industrial Technology Maintenance. The standards-based learning package will help students pass the testing and performance requirements for NIMS credentialing.

The correlation below lists the standards for a specific NIMS Classic ITM Credential. The Classic ITM areas covered in *Industrial Maintenance and Mechatronics* include Maintenance Operations, Basic Mechanical Systems, Basic Hydraulic Systems, Basic Pneumatic Systems, Electrical Systems, Electronic Control Systems, Process Control Systems, and Maintenance Piping.



Standards	G-W Content
Duty Title: 4.01. Adhere to fluid power systems safety rules.	
Identify roles and responsibilities for safety, health, and environment.	Textbook: pg. 13, 24-28, 36-44, 70
Adhere to OSHA, NIOSH, EPA, and other federal and state safety requirements for the workplace.	Textbook: pg. 18, 24-25, 43-44
Identify and recognize common industrial hazards, per OSHA standards (including, ergonomics, laser safety, NFPA arc flash, confined space, gases and combustibles, steam and compressed air).	Textbook: pg. 24-26
Define elements of a lockout/tagout (LOTO) program, describe the LOTO process and test to ensure a zero energy state.	Textbook: pg. 28-32 Lab Workbook: Activity 2-1, Lockout/Tagout Procedure

Standards	G-W Content
Identify and explain how to select the appropriate personal protective equipment (eyes, head, breathing air apparatus, body, feet, hands, ears) for a job.	Textbook: pg. 13, 32-35 Lab Workbook: Activity 2-2, Personal Protective Equipment
Explain how to locate a material Safety Data Sheet (SDS) and describe how you interpret the information.	Textbook: pg. 24-27
List and select proper fall protection for working at heights and using ladders, scaffolding, and lifts.	Textbook: pg. 37
Identify and recognize hazardous situations and apply proper procedures (includes following guidelines to prevent spread of bloodborne pathogens, spill control, proper storage, handling, protection of equipment, first aid).	Textbook: pg. 28-32, 36-43
Describe the process used to perform a job safety analysis.	Textbook: pg. 43 Lab Workbook: Activity 2-3, Job Safety Analysis
Explain the principles of 6S program (Sort, Sweep, Sanitize, Set-to-order, Sustain, Safety).	Textbook: pg. 43
Identify fuel source and selection of correct extinguisher class.	Textbook: pg. 43
Duty Title: 4.02. Adjust pneumatic system branch operating pressure using a regulator.	
Describe the operation of relieving and non-relieving pneumatic regulators.	Textbook: pg. 376-378 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Describe the pressure vs. force/ torque output characteristics of cylinders and motors.	Textbook: pg. 380, 387
Describe Pascal's law and its importance in reading system pressure.	Textbook: pg. 319-320
Interpret and convert between air pressure units of measurement (psi, psia, psig, kPa, bar).	Textbook: pg. 318, 322-325, 382 Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Describe the compressibility characteristics of air and their impact on system operation.	Textbook: pg. 320, 323, 374, 381,
Describe the operation of circuits using pneumatic directional control valves with manual and electrical operators, various types of spool centers, 2-position/3-position, pilot operated, cam-operated, and 2/3/4/5 way designs.	Textbook: pg. 131-133, 386, 391, 412 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Read a pressure gauge.	Textbook: pg. 318 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Use manufacturer's documentation to determine correct operating pressure.	Textbook: pg. 378-379 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks

Standards	G-W Content
Adjust pneumatic regulator pressure.	Textbook: pg. 376 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Operate a branch shutoff valve to enable flow to a system branch.	Textbook: pg. 383
Duty Title: 4.03. Adjust pneumatic actuator speed using a flow control valve.	
Describe the operation of a needle valve, flow control valve, and meter-in and meter-out circuits.	Textbook: pg. 385-387, 391-392 Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Describe the flow vs. speed characteristics of a pneumatic cylinder and a motor.	Textbook: pg. 320, 322, 380, 387, 391, Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Describe the effect of system pressure on pneumatic actuator speed.	Textbook: pg. 321-323 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using a needle valve.	Textbook: pg. 320, 391-392 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using a flow control valve.	Textbook: pg. 320-321, 391-392 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using manifold mounted flow control valves.	Textbook: pg. 385, 391-393
Adjust flow control valves in meter-in and meter-out configurations.	Textbook: pg. 391-392 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Measure actuator speed.	Textbook: pg. 391, 393 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Duty Title: 4.04. Service a pneumatic filter.	
Replace a cartridge filter.	Textbook: pg. 330, 331, Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Determine when to replace a filter based on inspection and pressure differential and manufacturer's recommendations.	Textbook: pg. 377-378 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance

Standards	G-W Content
Interpret filter specifications and models to determine correct filter.	Textbook: pg. 329, 331, 374-377 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Use manufacturer’s documentation to determine frequency of change.	Textbook: pg. 328, 331 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Operate the drain on a pneumatic filter.	Textbook: pg. 374-377 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Operate water removal systems on a pneumatic filter.	Textbook: pg. 374-376 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Recognize symptoms of excessive water in a compressed air system.	Textbook: pg. 381
Duty Title: 4.05. Service a pneumatic lubricator.	
Use manufacturer’s documentation to determine correct lubricant.	Textbook: pg. 377-378, 381 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Define proper lubricating media.	Textbook: pg. 227 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Inspect fluid level in a lubricator.	Textbook: pg. 227, 377 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Add lubricating oil to a lubricator.	Textbook: pg. 381 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Set lubrication rate on a lubricator.	Textbook: pg. 381 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Duty Title: 4.06. Install pneumatic conductors.	
Use safety procedures to make sure pressure is removed before disconnecting conductors.	Textbook: pg. 321, 381 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Attach and tighten pneumatic steel tubing using wrenches and ferrule fittings.	Textbook: pg. 333–334, 892 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings

Standards	G-W Content
Attach and tighten pneumatic fittings to components with threaded ports using wrenches and thread sealant when appropriate.	Textbook: pg. 334, 889–890, 903, 917–919 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1
Attach and tighten pneumatic hose using wrenches and straight-thread, barb, ferrule, and push-on fittings.	Textbook: pg. 902–904, 912, 917–919 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Adjust the position and alignment of conductors for proper operation.	Textbook: pg. 330–331, 334 Lab Workbook: Activity 15-4, Hydraulic Tubing and Fittings Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Interpret pipe, hose, and tubing specifications.	Textbook: pg. 334, 888–893 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Identify type and size of hose, tubing, and fittings given a sample.	Textbook: pg. 334, 888–893 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Identify fittings and application given a sample and explain limitations for use of each.	Textbook: pg. 916–919 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Duty Title: 4.07. Start up and shut down an air compressor and adjust operating pressure.	
Calculate air consumption from a receiver given a pressure change.	Textbook: pg. 382
Interpret and convert between airflow rate units (scfm, cfm, fcfm, etc.).	Textbook: pg. 382
Safely start up an air compressor system, including pre-start inspection.	Textbook: pg. 378-380, 381 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Safely shut down and drain a reciprocating air compressor system.	Textbook: pg. 378-380, 381 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Operate manual valves to direct system flow.	Textbook: pg. 354, 392-393
Use manufacturer’s documentation to determine correct operating pressure.	Textbook: pg. 352-353 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Adjust the system operating pressure using a pressure switch.	Textbook: pg. 379, 389-390 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks

Standards	G-W Content
Adjust working pressure with a regulator.	Textbook: pg. 376-377 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Duty Title: 4.08. Install and test components in a basic pneumatic circuit.	
Install and connect pneumatic components in basic functional circuit given a schematic.	Textbook: pg. 386, 391-393 Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Replace a sub plate-mounted directional valve in a pneumatic system.	Textbook: pg. 384–385, 404–405 Lab Workbook: Activity 16-2, Hydraulic Component Replacement Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1
Replace a threaded port valve.	Textbook: pg. 400–401 Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1
Mount and align a pneumatic cylinder or a motor.	Textbook: pg. 240–246, 387, 390
Operate a pneumatic system to determine that it is performing correctly.	Textbook: pg. 378–381, 393 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Describe types of cylinder and motor mounting methods and their applications.	Textbook: pg. 358–362, 380, 387–390
Duty Title: 4.09. Install and test components in a pneumatic vacuum generator circuit.	
Interpret vacuum units of measurement.	Textbook: pg. 393 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Describe Pascal’s law in relation to vacuum.	Textbook: pg. 319 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Calculate lifting force of a vacuum cup given vacuum level and manufacturer’s data.	Textbook: pg. 318–319, 393 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit

Standards	G-W Content
Describe common hose types, fittings, and sealants used in vacuum applications.	Textbook: pg. 334, 393 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Identify vacuum system and safeguards.	Textbook: pg. 333, 393 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Install and connect a vacuum generator and vacuum cups.	Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Duty Title: 4.10. Troubleshoot a basic pneumatic circuit.	
Troubleshoot basic components (cylinder, motor, directional valve, relief valve, pressure regulator valve, flow control valve, vacuum generator, suction cup, and check valve) in a pneumatic circuit using in-circuit tests.	Textbook: pg. 381, 384, 393 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Use flow and pressure instruments to take pneumatic circuit readings during in-circuit testing.	Textbook: pg. 149, 318–319, 804–806, 2287–888 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Describe the flow vs. pressure drop characteristics of pneumatic components and conductors and their impact on system operation.	Textbook: pg. 321-322, 377-378, 383
Use systematic methodologies to troubleshoot basic pneumatic circuits with linear and rotary actuators with these symptoms: Actuator will not move Actuator moves at incorrect speed Actuator moves erratically No or low system pressure	Textbook: pg. 366, 393, 406-408, 413-414 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Describe types of failures of basic pneumatic components.	Textbook: pg. 378, 381, Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits