Correlation of

Industrial Maintenance and Mechatronics,

Shawn A. Ballee and Gary R. Shearer

Goodheart-Willcox Publisher ©2028

to

NIMS (National Institute for Metalworking Skills)

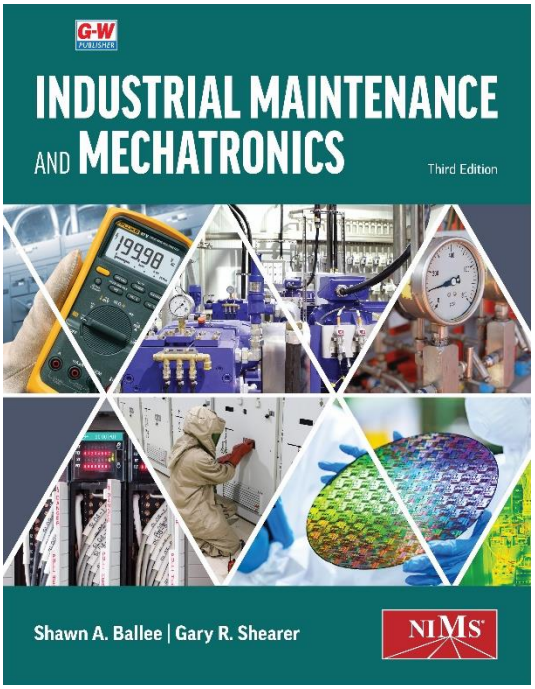
Classic Credential:

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: pgs. 12, 22–26, 33–41, 64
Adhere to OSHA, NIOSH, EPA, and other federal and state safety requirements for the workplace.	Textbook: pgs. 15–17, 22–25, 40–41
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: pgs. 22–25

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Define elements of a lockout/tagout (LOTO) program, describe the LOTO process and test to ensure a zero energy state.	Textbook: pgs. 26–29 Lab Workbook: Activity 2-1, Lockout/Tagout Procedure
Identify and explain how to select the appropriate personal protective equipment (eyes, head, breathing air apparatus, body, feet, hands, ears) for a job.	Textbook: pgs. 12, 29–33 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: pgs. 22–25
List and select proper fall protection for working at heights and using ladders, scaffolding, and lifts.	Textbook: pg. 34
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: pgs. 26–29, 33–40
Describe the process used to perform a job safety analysis.	Textbook: pg. 40 Lab Workbook: Activity 2-3, Job Safety Analysis
Explain the principles of 6S program (Sort, Sweep, Sanitize, Set-to-order, Sustain, Safety).	Textbook: pg. 41
Identify fuel source and selection of correct extinguisher class.	Textbook: pgs.39–40
Duty Title: 4.02. Adjust pneumatic system branch operating pressure using a regulator.	
Describe the operation of relieving and non-relieving pneumatic regulators.	Textbook: pgs. 336–338 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Describe the pressure vs. force/ torque output characteristics of cylinders and motors.	Textbook: pgs. 339, 346
Describe Pascal's law and its importance in reading system pressure.	Textbook: pg. 286
Interpret and convert between air pressure units of measurement (psi, psia, psig, kPa, bar).	Textbook: pgs. 285, 289–291, 341 Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Describe the compressibility characteristics of air and their impact on system operation.	Textbook: pgs. 286–285, 289, 334, 340–341
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: pgs. 120–122, 345, 349–350, 368 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Read a pressure gauge.	Textbook: pgs. 135–136, 285 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: pgs. 338–339 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Adjust pneumatic regulator pressure.	Textbook: pg. 336 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. 342
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: pgs. 343–345, 349–350 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: pgs. 286–288, 339, 346, 349–350 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. 289 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using a needle valve.	Textbook: pgs. 288, 316–317, 322–323, 350 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using a flow control valve.	Textbook: pgs. 287–289, 349–350 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Adjust actuator speed using manifold mounted flow control valves.	Textbook: pgs. 343, 357–359, 364
Adjust flow control valves in meter-in and meter-out configurations.	Textbook: pgs. 350 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Measure actuator speed.	Textbook: pgs. 317 Lab Workbook: Activity 18-3, Basic Pneumatic Circuits 2
Duty Title: 4.04. Service a pneumatic filter.	
Replace a cartridge filter.	Textbook: pgs. 296–297 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: pgs. 337–338 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Interpret filter specifications and models to determine correct filter.	Textbook: pgs. 293–297, 334–337 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Use manufacturer's documentation to determine frequency of change.	Textbook: pgs. 294, 297 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Operate the drain on a pneumatic filter.	Textbook: pgs. 334–337 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Operate water removal systems on a pneumatic filter.	Textbook: pgs. 334–337 Lab Workbook: Activity 17-1, Pneumatic Filter Maintenance
Recognize symptoms of excessive water in a compressed air system.	Textbook: pgs. 340–341
Duty Title: 4.05. Service a pneumatic lubricator.	
Use manufacturer's documentation to determine correct lubricant.	Textbook: pgs. 202–204, 336–338, 340 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Define proper lubricating media.	Textbook: pg. 204 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Inspect fluid level in a lubricator.	Textbook: pgs. 204, 336 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance
Add lubricating oil to a lubricator.	Textbook: pgs. 340 Lab Workbook: Activity 17-2, Pneumatic Lubricator Maintenance

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Set lubrication rate on a lubricator.	Textbook: pgs. 340 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: pgs. 289, 339, 342 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: pgs. 298–299, 787 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Attach and tighten pneumatic fittings to components with threaded ports using wrenches and thread sealant when appropriate.	Textbook: pgs.298–299, 785–786, 795–796, 807–809 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: pgs. 795–799, 803–804, 807–809 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Adjust the position and alignment of conductors for proper operation.	Textbook: pgs. 296–297, 298–299 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: pgs. 298–299, 784–788 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Identify type and size of hose, tubing, and fittings given a sample.	Textbook: pgs. 298–299, 784–788 Lab Workbook: Activity 17-4, Pneumatic Conductors and Fittings
Identify fittings and application given a sample and explain limitations for use of each.	Textbook: pgs. 807–809 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: pgs. 341
Interpret and convert between airflow rate units (scfm, cfm, fcfm, etc.).	Textbook: pgs. 341

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Safely start up an air compressor system, including pre-start inspection.	Textbook: pgs. 338–341 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Safely shut down and drain a reciprocating air compressor system.	Textbook: pgs. 338–341 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Operate manual valves to direct system flow.	Textbook: pgs. 314–316, 350
Use manufacturer's documentation to determine correct operating pressure.	Textbook: pgs. 314–315 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Adjust the system operating pressure using a pressure switch.	Textbook: pgs. 338–339, 347–348 Lab Workbook: Activity 17-3, System Start-Up and Operational Checks
Adjust working pressure with a regulator.	Textbook: pgs. 336–337 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: pgs. 345, 349–351 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: pgs. 343–345, 361–362 Lab Workbook: Activity 16-2, Hydraulic Component Replacement Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1
Replace a threaded port valve.	Textbook: pgs. 335, 357–358 Lab Workbook: Activity 18-2, Basic Pneumatic Circuits 1
Mount and align a pneumatic cylinder or a motor.	Textbook: pgs. 216–222, 346–349
Operate a pneumatic system to determine that it is performing correctly.	Textbook: pgs. 338–341, 351–352 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: pgs. 320–324, 339–340, 346–349
Duty Title: 4.09. Install and test components in a pneumatic vacuum generator circuit.	

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
Interpret vacuum units of measurement.	Textbook: pgs. 350, 827–829 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: pgs. 286 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: pgs. 285–286, 350 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Describe common hose types, fittings, and sealants used in vacuum applications.	Textbook: pgs. 298–299, 370, 834–836 Lab Workbook: Activity 15-5, Pneumatic Vacuum Systems Lab Workbook: Activity 17-5, Vacuum Generator Circuit
Identify vacuum system and safeguards.	Textbook: pgs. 298, 350, 441, 826–838 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: pgs. 340–343, 351–352 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: pgs. 135–136, 285–286, 711–712, 782 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: pgs. 289, 337–338, 342

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.

Standards	G-W Content
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: pgs. 327, 351–352, 364–365, 369–370 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits
Describe types of failures of basic pneumatic components.	Textbook: pgs. 338–340 Lab Workbook: Activity 18-4, Troubleshooting Pneumatic Circuits

Copyright © Goodheart-Willcox Co., Inc. All Rights Reserved. You may not reproduce, create derivative works from, utilize any AI technology with respect to, or allow unauthorized access to, any G-W course or other materials, except as permitted by U.S. copyright law. Such materials may be used for your own educational purposes only, in a location not accessible by the general public.