

CONTENT STANDARD 1.0: LAB ORGANIZATION AND SAFETY PROCEDURES

Performance Standard 1.1: General Lab Safety Rules and Procedures

- 1.1.1 Describe general shop safety rules and procedures.
- 1.1.2 Demonstrate knowledge of OSHA and its role in workplace safety.
- 1.1.3 Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities (i.e., personal protection equipment – PPE).
- 1.1.4 Operate lab equipment according to safety guidelines.
- 1.1.5 Identify and use proper lifting procedures and proper use of support equipment.
- 1.1.6 Utilize proper ventilation procedures for working within the lab/shop area.
- 1.1.7 Identify marked safety areas and safety signage.
- 1.1.8 Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
- 1.1.9 Identify the location and use of eye wash stations.
- 1.1.10 Identify the location of the posted evacuation routes.
- 1.1.11 Identify and wear appropriate clothing for lab/shop activities.
- 1.1.12 Secure hair and jewelry for lab/shop activities.
- 1.1.13 Understand knowledge of the safety aspects of low and high voltage circuits.
- 1.1.14 Locate and interpret safety data sheets (SDS).
- 1.1.15 Perform housekeeping duties.
- 1.1.16 Follow verbal instructions to complete work assignments.
- 1.1.17 Follow written instructions to complete work assignments.

Performance Standard 1.2: Hand Tools

- 1.2.1 Identify hand tools and their appropriate usage.
- 1.2.2 Identify standards and metric designation.
- 1.2.3 Demonstrate the proper techniques when using hand tools.
- 1.2.4 Demonstrate safe handling and use of appropriate tools.
- 1.2.5 Identify proper cleaning, storage and maintenance of tools.

Performance Standard 1.3: Power Tools and Equipment

- 1.3.1 Identify power tools and their appropriate usage.
- 1.3.2 Identify equipment and their appropriate usage.
- 1.3.3 Demonstrate the proper techniques when using power tools and equipment.
- 1.3.4 Demonstrate safe handling and use of appropriate power tools and equipment.
- 1.3.5 Identify proper cleaning, storage and maintenance of power tools and equipment.

CONTENT STANDARD 2.0: IMPACT OF ENGINEERING

Performance Standard 2.1: Engineering History

- 2.1.1 Define engineering.
- 2.1.2 Identify engineering achievements throughout history.
- 2.1.3 Research how historical period and regional style have influenced engineering design.

- 2.1.4 Investigate the evolution of a product.

Performance Standard 2.2: Engineering Careers

- 2.2.1 Investigate engineering careers, training, and associated opportunities.
- 2.2.2 Describe the difference between engineering disciplines and job functions.
- 2.2.3 Explore career opportunities and list the educational requirements for a given engineering field.
- 2.2.4 Describe the importance of engineering teams.
- 2.2.5 Differentiate the careers associated with associates degrees, bachelor degrees, and master plus degrees.

Performance Standard 2.3: Ethics in Engineering

- 2.3.1 Knowledge of current professional engineering codes of ethics.
- 2.3.2 Knowledge of ethical engineering issues.
- 2.3.3 Apply and explain how ethical and technical issues contribute to an engineering disaster.
- 2.3.4 Describe how ethics influence the engineering process.

CONTENT STANDARD 3.0: ENGINEERING DESIGN PROCESS

Performance Standard 3.1: Design Process

- 3.1.1 Identify and understand the common elements of a design process, including define the problem, generate concepts, develop a solution, develop a design proposal, construct and test a prototype, refine the design, evaluate a solution and communicate the processes and results.
- 3.1.2 Apply the steps of the design process to solve a design problem.
- 3.1.3 Describe how social, environmental, and financial constraints influence the design process.
- 3.1.4 Diagram the lifecycle of a product.

CONTENT STANDARD 4.0: ENGINEERING DOCUMENTATION

Performance Standard 4.1: Freehand Technical Sketching Techniques

- 4.1.1 Develop design ideas using freehand sketching.
- 4.1.2 Identify the six primary orthographic views.
- 4.1.3 Create pictorial and multi-view sketches.
- 4.1.4 Utilize the alphabet of lines (i.e., styles and weights) and/or line conventions.
- 4.1.5 Legibly annotate sketches.

Performance Standard 4.2: Measuring and Scaling Techniques

- 4.2.1 Identify industry standard units of measure.
- 4.2.2 Convert between industry standard units of measure.
- 4.2.3 Determine appropriate engineering and metric scales.
- 4.2.4 Measure speed, distance, object size, area, mass, volume, and temperature.
- 4.2.5 Determine and apply the equivalence between fractions and decimals.
- 4.2.6 Demonstrate proper use of precision measuring tools.

Performance Standard 4.3: Engineering Documentation Procedures

- 4.3.1 Demonstrate record keeping procedures and communication in engineering.
- 4.3.2 Identify the importance of proprietary documentation in engineering.
- 4.3.3 Understand the copyright and patent process.
- 4.3.4 Illustrate project management timelines.
- 4.3.5 Create a written technical report.

Performance Standard 4.4: Technical Drawings

- 4.4.1 Interpret basic elements of a technical drawing (i.e., title block information, dimensions, and line types).
- 4.4.2 Produce drawings from sketches.
- 4.4.3 Identify industry standard symbols.
- 4.4.4 Describe and construct various types of drawings (i.e., part, assembly, pictorial, orthographic, isometric, and schematic) using proper symbols.
- 4.4.5 Construct drawings utilizing metric and customary (i.e., SAE and Imperial) measurement systems.
- 4.4.6 Arrange dimensions and annotations using appropriate standards (i.e., ANSI and ISO).
- 4.4.7 Construct bill of materials or schedule.

Performance Standard 4.5: Modeling Techniques

- 4.5.1 Identify the areas of modeling (i.e., physical, conceptual, and mathematical).
- 4.5.2 Create a scale model or working prototype.
- 4.5.3 Evaluate a scale model or a working prototype.

CONTENT STANDARD 5.0: MATERIAL PROPERTIES

Performance Standards 5.1: Material Properties and Science

- 5.1.1 Identify the major material families used in manufacturing.
- 5.1.2 Differentiate between the various types of material properties and their applications.
- 5.1.3 Discuss the impact of material usage on the environment.
- 5.1.4 Explain how cost in production is affected by the availability, quality, and quantity of resources.
- 5.1.5 Differentiate among raw material standard stock and finished products.

Performance Standards 5.2: Materials Strength

- 5.2.1 Describe the various forms of stress (i.e., compression, tension, torque, and shear).
- 5.2.2 Recognize and describe a stress strain curve.
- 5.2.3 Create free body diagrams of objects, identifying all forces acting on the object.
- 5.2.4 Differentiate between scalar and vector quantities.
- 5.2.5 Understand magnitude, direction, and sense of a vector.
- 5.2.6 Understand moment and torque forces.

CONTENT STANDARD 6.0: FUNDAMENTAL POWER SYSTEMS AND ENERGY PRINCIPLES

Performance Standard 6.1: Power Systems and Energy Forms

- 6.1.1 Define terms used in power systems (e.g., power, work, horsepower, watts, etc.).
- 6.1.2 Identify the basic power systems.
- 6.1.3 List the basic elements of power systems.
- 6.1.4 Summarize the advantages and disadvantages of various forms of power.
- 6.1.5 Calculate the efficiency of power systems and conversion devices.
- 6.1.6 Define energy.
- 6.1.7 Define potential energy and kinetic energy.
- 6.1.8 Identify forms of potential energy and kinetic energy.
- 6.1.9 Categorize types of energy into major forms such as, thermal, radiant, nuclear, chemical, electrical, mechanical, and fluid.
- 6.1.10 Identify units used to measure energy.
- 6.1.11 Analyze and apply data and measurements to solve problems and interpret documents.
- 6.1.12 Calculate unit conversions between common energy measurements.
- 6.1.13 Demonstrate an energy conversion device.

Performance Standard 6.2: Basic Mechanical Systems

- 6.2.1 Distinguish between the six simple machines, their attributes and components.
- 6.2.2 Measure forces and distances related to mechanisms.
- 6.2.3 Determine efficiency in a mechanical system.
- 6.2.4 Calculate mechanical advantage and drive ratios of mechanisms.
- 6.2.5 Calculate work, power, torque and/or moments.
- 6.2.6 Design, construct, and test various basic mechanical systems.

Performance Standard 6.3: Energy Sources and Applications

- 6.3.1 Identify and categorize energy sources as nonrenewable, renewable, or inexhaustible.
- 6.3.2 Define the possible types of power conversion.
- 6.3.3 Measure circuit values using a multimeter.
- 6.3.4 Calculate power in a system that converts energy from electrical to mechanical.
- 6.3.5 Determine efficiency of a system that converts an electrical input to a mechanical output.
- 6.3.6 Compute values of current, resistance, and voltage using Ohm's law.
- 6.3.7 Solve series and parallel circuits using basic laws of electricity including Kirchhoff's laws.
- 6.3.8 Test and apply the relationship between voltage, current, and resistance relating to a photovoltaic cell and a hydrogen fuel cell.

Performance Standard 6.4: Machine Control Systems

- 6.4.1 Create detailed operational flowcharts.
- 6.4.2 Create system control programs (i.e., sequential, logic)
- 6.4.3 Select appropriate input and output devices based on system specifications and constraints.

- 6.4.4 Differentiate between the characteristics of digital and analog devices.
- 6.4.5 Compare and contrast open and closed loop systems.
- 6.4.6 Design and create a control system based on specifications and constraints.

Performance Standard 6.5: Basic Fluid Systems

- 6.5.1 Define fluid systems (e.g., hydraulic, pneumatic, vacuum, etc.).
- 6.5.2 Identify and define the components of fluid systems.
- 6.5.3 Compare and contrast hydraulic and pneumatic systems.
- 6.5.4 Identify the advantages and disadvantages of using fluid power systems.
- 6.5.5 Explain the difference between gauge pressure and absolute pressure.
- 6.5.6 Discuss the safety concerns of working with liquids and gases under pressure.
- 6.5.7 Calculate mechanical advantage using Pascal's law.
- 6.5.8 Calculate values in a pneumatic system using the ideal gas laws.

CONTENT STANDARD 7.0: STATISTICS AND KINEMATIC PRINCIPLES

Performance Standard 7.1: Statistics

- 7.1.1 Define statistical terminology.
- 7.1.2 Create a histogram to illustrate frequency distribution.
- 7.1.3 Calculate the central tendency of a data array to include mean, median, and mode.
- 7.1.4 Calculate data variation to include range, standard deviation, and variance.

Performance Standard 7.2: Kinematic Principles

- 7.2.1 Define kinematic terminology.
- 7.2.2 Calculate distance, displacement, speed, velocity, and acceleration based on specific data.
- 7.2.3 Calculate acceleration due to gravity based on data from a free-fall device.