



**Manufacturing Career Cluster  
Manufacturing Production Process Development Pathway  
Knowledge and Skill Statements**

The Pathway Knowledge and Skills Chart describes what all/most learners/workers need to know and be able to do to demonstrate competence within a career pathway. Following the pathway description, there are four sets of knowledge and skill expectations:

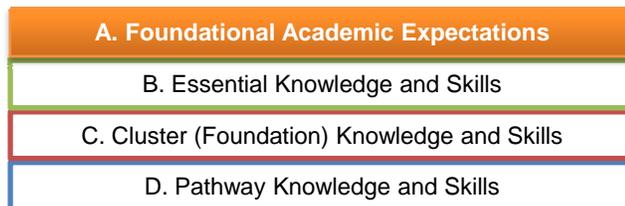


**PATHWAY DESCRIPTION**

*Manufacturing Production Process Development Pathway:* Employees in Manufacturing Production Process Development are responsible for product design and design of the manufacturing process. They work with customers to ensure the manufacturing process produces a product that meets or exceeds customer expectations. They also monitor the manufacturing process and the materials used to manufacture the product.

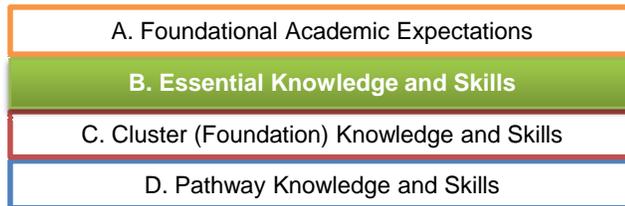
**A. FOUNDATIONAL ACADEMIC EXPECTATIONS**

All secondary students should meet their state’s academic standards. All Essential Cluster and Pathway Knowledge and Skills are predicated on the assumption that foundational academic skills have been attained. Some knowledge and skill statements will further define critical linkages and applications of academics in the cluster and/or pathway.



**B. ESSENTIAL KNOWLEDGE AND SKILLS**

The following Essential Knowledge and Skill statements apply to careers in all clusters and pathways. Persons preparing for careers in this pathway should be able to demonstrate these skills in the context of this cluster and pathway.



**Essential Topic**    **ACADEMIC FOUNDATIONS:** *Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.*  
**ESS01**



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

**ESS01.01 Complete required training, education, and certification to prepare for employment in a particular career field.**

- ESS01.01.01 Identify training, education and certification requirements for occupational choice.
- ESS01.01.02 Participate in career-related training and/or degree programs.
- ESS01.01.03 Pass certification tests to qualify for licensure and/or certification in chosen occupational area.

**ESS01.02 Demonstrate language arts knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**

- ESS01.02.01 Model behaviors that demonstrate active listening.
- ESS01.02.02 Adapt language for audience, purpose, situation. (i.e. diction/structure, style).
- ESS01.02.03 Organize oral and written information.
- ESS01.02.04 Compose focused copy for a variety of written documents such as agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
- ESS01.02.05 Edit copy to create focused written documents such as agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
- ESS01.02.06 Comprehend key elements of oral and written information such as cause/effect, comparisons/contrasts, conclusions, context, purpose, charts/tables/graphs, evaluation/critiques, mood, persuasive text, sequence, summaries, and technical subject matter.
- ESS01.02.07 Evaluate oral and written information for accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, and relationship of ideas.
- ESS01.02.08 Identify assumptions, purpose, outcomes/solutions, and propaganda techniques.
- ESS01.02.09 Predict potential outcomes and/or solutions based on oral and written information regarding trends.
- ESS01.02.10 Present formal and informal speeches including discussion, information requests, interpretation, and persuasive arguments.

**ESS01.03 Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**

- ESS01.03.01 Identify whole numbers, decimals, and fractions.
- ESS01.03.02 Demonstrate knowledge of basic arithmetic operations such as addition, subtraction, multiplication, and division.
- ESS01.03.03 Demonstrate use of relational expressions such as equal to, not equal, greater than, less than, etc.
- ESS01.03.04 Apply data and measurements to solve a problem.
- ESS01.03.05 Analyze Mathematical problem statements for missing and/or irrelevant data.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS01.03.06 Construct charts/tables/graphs from functions and data.

ESS01.03.07 Analyze data when interpreting operational documents.

**ESS01.04 Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.**

ESS01.04.01 Evaluate scientific constructs including conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.

ESS01.04.02 Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.

**Essential Topic**  
**ESS02**  
**COMMUNICATIONS: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.**

**ESS02.01 Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.**

ESS02.01.01 Determine the most appropriate reading strategy for identifying the overarching purpose of a text (i.e. skimming, reading for detail, reading for meaning or critical analysis).

ESS02.01.02 Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions.

ESS02.01.03 Select the reading strategy or strategies needed to fully comprehend the content within a written document (i.e., skimming, reading for detail, reading for meaning or critical analysis).

ESS02.01.04 Interpret information, data, and observations to apply information learned from reading to actual practice.

ESS02.01.05 Transcribe information, data, and observations to apply information learned from reading to actual practice.

ESS02.01.06 Communicate information, data, and observations to apply information learned from reading to actual practice.

**ESS02.02 Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication in the workplace.**

ESS02.02.01 Employ verbal skills when obtaining and conveying information.

ESS02.02.02 Record information needed to present a report on a given topic or problem.

ESS02.02.03 Write internal and external business correspondence that conveys and/or obtains information effectively.

ESS02.02.04 Communicate with other employees to clarify workplace objectives.

ESS02.02.05 Communicate effectively with customers and employees to foster positive relationships.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

- ESS02.03      Locate, organize and reference written information from various sources to communicate with co-workers and clients/participants.**
- ESS02.03.01      Locate written information used to communicate with co-workers and customers.
  - ESS02.03.02      Organize information to use in written and oral communications.
  - ESS02.03.03      Reference the sources of information.
- ESS02.04      Evaluate and use information resources to accomplish specific occupational tasks.**
- ESS02.04.01      Use informational texts, Internet web sites, and/or technical materials to review and apply information sources for occupational tasks.
  - ESS02.04.02      Evaluate the reliability of information from informational texts, Internet Web sites, and/or technical materials and resources.
- ESS02.05      Use correct grammar, punctuation and terminology to write and edit documents.**
- ESS02.05.01      Compose multi-paragraph documents clearly, succinctly, and accurately.
  - ESS02.05.02      Use descriptions of audience and purpose when preparing and editing written documents.
  - ESS02.05.03      Use correct grammar, spelling, punctuation, and capitalization when preparing written documents.
- ESS02.06      Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.**
- ESS02.06.01      Prepare oral presentations to provide information for specific purposes and audiences.
  - ESS02.06.02      Identify support materials that will enhance an oral presentation.
  - ESS02.06.03      Prepare support materials that will enhance an oral presentation.
  - ESS02.06.04      Deliver an oral presentation that sustains listeners' attention and interest.
  - ESS02.06.05      Align presentation strategies to the intended audience.
  - ESS02.06.06      Implement multi-media strategies for presentations.
- ESS02.07      Interpret verbal and nonverbal cues/behaviors to enhance communication with co-workers and clients/participants.**
- ESS02.07.01      Interpret verbal behaviors when communicating with clients and co-workers.
  - ESS02.07.02      Interpret nonverbal behaviors when communicating with clients and co-workers.
- ESS02.08      Apply active listening skills to obtain and clarify information.**
- ESS02.08.01      Interpret a given verbal message/information.
  - ESS02.08.02      Respond with restatement and clarification techniques to clarify information.
- ESS02.09      Develop and interpret tables, charts, and figures to support written and oral communications.**



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

- ESS02.09.01 Create tables, charts, and figures to support written and oral communications.
- ESS02.09.02 Interpret tables, charts, and figures used to support written and oral communication.

**ESS02.10 Listen to and speak with diverse individuals to enhance communication skills.**

- ESS02.10.01 Apply factors and strategies for communicating with a diverse workforce.
- ESS02.10.02 Demonstrate ability to communicate and resolve conflicts within a diverse workforce.

**ESS02.11 Exhibit public relations skills to increase internal and external customer/client satisfaction.**

- ESS02.11.01 Communicate effectively when developing positive customer/client relationships.

**Essential Topic**  
**ESS03**  
**PROBLEM-SOLVING AND CRITICAL THINKING: *Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.***

**ESS03.01 Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).**

- ESS03.01.01 Identify common tasks that require employees to use problem-solving skills.
- ESS03.01.02 Analyze elements of a problem to develop creative solutions.
- ESS03.01.03 Describe the value of using problem-solving and critical thinking skills to improve a situation or process.
- ESS03.01.04 Create ideas, proposals, and solutions to problems.
- ESS03.01.05 Evaluate ideas, proposals, and solutions to problems.
- ESS03.01.06 Use structured problem-solving methods when developing proposals and solutions.
- ESS03.01.07 Generate new and creative ideas to solve problems by brainstorming possible solutions.
- ESS03.01.08 Critically analyze information to determine value to the problem-solving task.
- ESS03.01.09 Guide individuals through the process of recognizing concerns and making informed decisions.
- ESS03.01.10 Identify alternatives using a variety of problem-solving and critical thinking skills.
- ESS03.01.11 Evaluate alternatives using a variety of problem-solving and critical thinking skills.

**ESS03.02 Employ critical thinking and interpersonal skills to resolve conflicts with staff and/or customers.**

- ESS03.02.01 Analyze situations and behaviors that affect conflict management.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

- ESS03.02.02 Determine best options/outcomes for conflict resolution using critical thinking skills.
- ESS03.02.03 Identify with others' feelings, needs, and concerns.
- ESS03.02.04 Implement stress management techniques.
- ESS03.02.05 Resolve conflicts with/for customers using conflict resolution skills.
- ESS03.02.06 Implement conflict resolution skills to address staff issues/problems.

**ESS03.03** **Identify, write and monitor workplace performance goals to guide progress in assigned areas of responsibility and accountability.**

- ESS03.03.01 Write realistic performance goals, objectives and action plans.
- ESS03.03.02 Monitor performance goals and adjust as necessary.
- ESS03.03.03 Recognize goal achievement using appropriate rewards in the workplace.

**ESS03.04** **Conduct technical research to gather information necessary for decision-making.**

- ESS03.04.01 Align the information gathered to the needs of the audience.
- ESS03.04.02 Gather technical information and data using a variety of resources.
- ESS03.04.03 Analyze information and data for value to the research objectives.
- ESS03.04.04 Evaluate information and data to determine value to research objectives.

**Essential Topic**  
**ESS04** **INFORMATION TECHNOLOGY APPLICATIONS: *Use information technology tools specific to the career cluster to access, manage, integrate, and create information.***

**ESS04.01** **Use Personal Information Management (PIM) applications to increase workplace efficiency.**

- ESS04.01.01 Manage personal schedules and contact information.
- ESS04.01.02 Create memos and notes.

**ESS04.02** **Employ technological tools to expedite workflow.**

- ESS04.02.01 Use information technology tools to manage and perform work responsibilities.

**ESS04.03** **Operate electronic mail applications to communicate within a workplace.**

- ESS04.03.01 Use email to share files and documents.
- ESS04.03.02 Identify the functions and purpose of email systems.
- ESS04.03.03 Use email to communicate within and across organizations.

**ESS04.04** **Operate Internet applications to perform workplace tasks.**

- ESS04.04.01 Access and navigate Internet (e.g., use a web browser).
- ESS04.04.02 Search for information and resources.
- ESS04.04.03 Evaluate Internet resources for reliability and validity.

**ESS04.05** **Operate writing and publishing applications to prepare business communications.**

- ESS04.05.01 Prepare simple documents and other business communications.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS04.05.02 Prepare reports and other business communications by integrating graphics and other non-text elements.

ESS04.05.03 Prepare complex multi-media publications.

**ESS04.06 Operate presentation applications to prepare presentations.**

ESS04.06.01 Prepare presentations for training, sales and information sharing.

ESS04.06.02 Deliver presentations with supporting materials.

**ESS04.07 Employ spreadsheet applications to organize and manipulate data.**

ESS04.07.01 Create a spreadsheet.

ESS04.07.02 Perform calculations and analyses on data using a spreadsheet.

**ESS04.08 Employ database applications to manage data.**

ESS04.08.01 Manipulate data elements.

ESS04.08.02 Manage interrelated data elements.

ESS04.08.03 Analyze interrelated data elements.

ESS04.08.04 Generate reports showing interrelated data elements.

**ESS04.09 Employ collaborative/groupware applications to facilitate group work.**

ESS04.09.01 Facilitate group work through management of shared schedule and contact information.

ESS04.09.02 Facilitate group work through management of shared files and online information.

ESS04.09.03 Facilitate group work through instant messaging or virtual meetings.

**ESS04.10 Employ computer operations applications to manage work tasks.**

ESS04.10.01 Manage computer operations.

ESS04.10.02 Manage file storage.

ESS04.10.03 Compress or alter files.

**ESS04.11 Use computer-based equipment (containing embedded computers or processors) to control devices.**

ESS04.11.01 Operate computer driven equipment and machines.

ESS04.11.02 Use installation and operation manuals.

ESS04.11.03 Troubleshoot computer driven equipment and machines.

ESS04.11.04 Access support as needed to maintain operation of computer driven equipment and machines.

**Essential Topic**  
**ESS05**

**SYSTEMS:** *Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.*

**ESS05.01 Describe the nature and types of business organizations to build an understanding of the scope of organizations.**

ESS05.01.01 List the types and functions of businesses.

ESS05.01.02 Describe the types and functions of businesses.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS05.01.03 Explain the functions and interactions of common departments within a business.

**ESS05.02 Implement quality control systems and practices to ensure quality products and services.**

ESS05.02.01 Describe quality control standards and practices common to the workplace.

**Essential Topic**  
**ESS06**

**SAFETY, HEALTH AND ENVIRONMENTAL:** *Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.*

**ESS06.01 Implement personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.**

ESS06.01.01 Assess workplace conditions with regard to safety and health.

ESS06.01.02 Align safety issues with appropriate safety standards to ensure a safe workplace/jobsite.

ESS06.01.03 Identify safety hazards common to workplaces.

ESS06.01.04 Identify safety precautions to maintain a safe worksite.

ESS06.01.05 Select appropriate personal protective equipment as needed for a safe workplace/jobsite.

ESS06.01.06 Inspect personal protective equipment commonly used for selected career pathway.

ESS06.01.07 Use personal protective equipment according to manufacturer rules and regulations.

ESS06.01.08 Employ a safety hierarchy and communication system within the workplace/jobsite.

ESS06.01.09 Implement safety precautions to maintain a safe worksite.

**ESS06.02 Complete work tasks in accordance with employee rights and responsibilities and employers obligations to maintain workplace safety and health.**

ESS06.02.01 Identify rules and laws designed to promote safety and health in the workplace.

ESS06.02.02 State the rationale of rules and laws designed to promote safety and health.

**ESS06.03 Employ emergency procedures as necessary to provide aid in workplace accidents.**

ESS06.03.01 Use knowledge of First Aid procedures as necessary.

ESS06.03.02 Use knowledge of CPR procedures as necessary.

ESS06.03.03 Use safety equipment as necessary.

**ESS06.04 Employ knowledge of response techniques to create a disaster and/or emergency response plan.**

ESS06.04.01 Complete an assessment of an emergency and/or disaster situation.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS06.04.02 Create an emergency and/or disaster plan.

**Essential Topic**  
**ESS07**

**LEADERSHIP AND TEAMWORK:** *Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.*

**ESS07.01**

**Employ leadership skills to accomplish organizational goals and objectives.**

- ESS07.01.01 Analyze the various roles of leaders within organizations (e.g. contribute ideas; share in building an organization; act as role models to employees by adhering to company policies, procedures, and standards; promote the organization's vision; and mentor others).
- ESS07.01.02 Exhibit traits such as empowerment, risk, communication, focusing on results, decision-making, problem solution, and investment in individuals when leading a group in solving a problem.
- ESS07.01.03 Exhibit traits such as compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others when acting as a manager of others in the workplace.
- ESS07.01.04 Exhibit traits such as enthusiasm, creativity, conviction, mission, courage, concept, focus, principle-centered living, and change when interacting with others in general.
- ESS07.01.05 Consider issues related to self, team, community, diversity, environment, and global awareness when leading others.
- ESS07.01.06 Exhibit traits such as innovation, intuition, adaptation, life-long learning and coachability to develop leadership potential over time.
- ESS07.01.07 Analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation.
- ESS07.01.08 Describe observations of outstanding leaders using effective management styles.
- ESS07.01.09 Participate in civic and community leadership and teamwork opportunities to enhance skills.

**ESS07.02**

**Employ organizational and staff development skills to foster positive working relationships and accomplish organizational goals.**

- ESS07.02.01 Implement organizational skills when facilitating others' work efforts.
- ESS07.02.02 Explain how to manage a staff that satisfies work demands while adhering to budget constraints.
- ESS07.02.03 Describe how staff growth and development to increase productivity and employee satisfaction.
- ESS07.02.04 Organize team involvement within a group environment.
- ESS07.02.05 Work with others to develop and gain commitment to team goals.
- ESS07.02.06 Distribute responsibility and work load fairly.
- ESS07.02.07 Model leadership and teamwork qualities to aid in employee morale.
- ESS07.02.08 Identify best practices for successful team functioning.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS07.02.09	Explain best practices for successful team functioning.
<b>ESS07.03</b>	<b>Employ teamwork skills to achieve collective goals and use team members' talents effectively.</b>
ESS07.03.01	Work with others to achieve objectives in a timely manner.
ESS07.03.02	Promote the full involvement and use of team members' individual talents and skills.
ESS07.03.03	Employ conflict-management skills to facilitate solutions.
ESS07.03.04	Demonstrate teamwork skills through working cooperatively with co-workers, supervisory staff, and others, both in and out of the organization, to achieve particular tasks.
ESS07.03.05	Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution.
ESS07.03.06	Develop plans to improve team performance.
ESS07.03.07	Demonstrate commitment to and a positive attitude toward team goals.
ESS07.03.08	Take responsibility for shared group and individual work tasks.
ESS07.03.09	Assist team members in completing their work.
ESS07.03.10	Adapt effectively to changes in projects and work activities.
ESS07.03.11	Negotiate effectively to arrive at decisions.
<b>ESS07.04</b>	<b>Establish and maintain effective working relationships with all levels of personnel and other departments in order to accomplish objectives and tasks.</b>
ESS07.04.01	Build effective working relationships using interpersonal skills.
ESS07.04.02	Use positive interpersonal skills to work cooperatively with co-workers representing different cultures, genders and backgrounds.
ESS07.04.03	Manage personal skills to accomplish assignments.
ESS07.04.04	Treat people with respect.
ESS07.04.05	Provide constructive praise and criticism.
ESS07.04.06	Demonstrate sensitivity to and value for diversity.
ESS07.04.07	Manage stress and control emotions.
<b>ESS07.05</b>	<b>Conduct and participate in meetings to accomplish work tasks.</b>
ESS07.05.01	Develop meeting goals, objectives and agenda.
ESS07.05.02	Assign responsibilities for preparing materials and leading discussions.
ESS07.05.03	Prepare materials for leading discussion.
ESS07.05.04	Assemble and distribute meeting materials.
ESS07.05.05	Conduct meeting to achieve objectives within scheduled time.
ESS07.05.06	Demonstrate effective communication skills in meetings.
ESS07.05.07	Produce meeting minutes including decisions and next steps.
ESS07.05.08	Use parliamentary procedure, as needed, to conduct meetings.
<b>ESS07.06</b>	<b>Employ mentoring skills to inspire and teach others.</b>
ESS07.06.01	Use motivational techniques to enhance performance in others.
ESS07.06.02	Provide guidance to enhance performance in others.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

<b>Essential Topic</b>	<b>ETHICS AND LEGAL RESPONSIBILITIES: <i>Know and understand the importance of professional ethics and legal responsibilities.</i></b>
<b>ESS08</b>	
<b>ESS08.01</b>	<b>Apply ethical reasoning to a variety of workplace situations in order to make ethical decisions.</b>
ESS08.01.01	Evaluate alternative responses to workplace situations based on legal responsibilities and employer policies.
ESS08.01.02	Evaluate alternative responses to workplace situations based on personal or professional ethical responsibilities.
ESS08.01.03	Identify personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.04	Explain personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.05	Determine the most appropriate response to workplace situations based on legal and ethical considerations.
ESS08.01.06	Explain the most appropriate response to workplace situations based on legal and ethical considerations.
<b>ESS08.02</b>	<b>Interpret and explain written organizational policies and procedures to help employees perform their jobs according to employer rules and expectations.</b>
ESS08.02.01	Locate information on organizational policies in handbooks and manuals.
ESS08.02.02	Discuss how specific organizational policies and procedures influence a specific work situation.
<b>Essential Topic</b>	<b>EMPLOYABILITY AND CAREER DEVELOPMENT: <i>Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills.</i></b>
<b>ESS09</b>	
<b>ESS09.01</b>	<b>Identify and demonstrate positive work behaviors and personal qualities needed to be employable.</b>
ESS09.01.01	Demonstrate self-discipline, self-worth, positive attitude, and integrity in a work situation.
ESS09.01.02	Demonstrate flexibility and willingness to learn new knowledge and skills.
ESS09.01.03	Exhibit commitment to the organization.
ESS09.01.04	Identify how work varies with regard to site, from indoor confined spaces to outdoor areas, including aerial space and a variety of climatic and physical conditions.
ESS09.01.05	Apply communication strategies when adapting to a culturally diverse environment.
ESS09.01.06	Manage resources in relation to the position (i.e. budget, supplies, computer, etc).
ESS09.01.07	Identify positive work-qualities typically desired in each of the career cluster's pathways.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS09.01.08      Manage work roles and responsibilities to balance them with other life roles and responsibilities.

**ESS09.02      Develop a personal career plan to meet career goals and objectives.**

ESS09.02.01      Develop career goals and objectives as part of a plan for future career direction.

ESS09.02.02      Develop strategies to reach career objectives.

**ESS09.03      Demonstrate skills related to seeking and applying for employment to find and obtain a desired job.**

ESS09.03.01      Use multiple resources to locate job opportunities.

ESS09.03.02      Prepare a résumé.

ESS09.03.03      Prepare a letter of application.

ESS09.03.04      Complete an employment application.

ESS09.03.05      Interview for employment.

ESS09.03.06      List the standards and qualifications that must be met in order to enter a given industry.

ESS09.03.07      Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer.

**ESS09.04      Maintain a career portfolio to document knowledge, skills and experience in a career field.**

ESS09.04.01      Select educational and work history highlights to include in a career portfolio.

ESS09.04.02      Produce a record of work experiences, licenses, certifications and products.

ESS09.04.03      Organize electronic or physical portfolio for use in demonstrating knowledge, skills and experiences.

**ESS09.05      Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.**

ESS09.05.01      Compare employment opportunities to individual needs and career plan objectives.

ESS09.05.02      Evaluate employment opportunities based upon individual needs and career plan objectives.

ESS09.05.03      Demonstrate appropriate methods for accepting or rejecting employment offers.

**ESS09.06      Identify and exhibit traits for retaining employment to maintain employment once secured.**

ESS09.06.01      Model behaviors that demonstrate reliability and dependability.

ESS09.06.02      Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.

ESS09.06.03      Complete required employment forms and documentation such as I-9 form, work visa, W-4 and licensures to meet employment requirements.

ESS09.06.04      Summarize key activities necessary to retain a job in the industry.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

ESS09.06.05 Identify positive work behaviors and personal qualities necessary to retain employment.

**ESS09.07 Identify and explore career opportunities in one or more career pathways to build an understanding of the opportunities available in the cluster.**

ESS09.07.01 Locate and identify career opportunities that appeal to personal career goals.

ESS09.07.02 Match personal interest and aptitudes to selected careers.

**ESS09.08 Recognize and act upon requirements for career advancement to plan for continuing education and training.**

ESS09.08.01 Identify opportunities for career advancement.

ESS09.08.02 Pursue education and training opportunities to acquire skills necessary for career advancement.

ESS09.08.03 Examine the organization and structure of various segments of the industry to prepare for career advancement.

ESS09.08.04 Research local and regional labor (workforce) market and job growth information to project potential for advancement.

ESS09.08.05 Manage employment relations to make career advancements.

**ESS09.09 Continue professional development to keep current on relevant trends and information within the industry.**

ESS09.09.01 Use self assessment, organizational priorities, journals, Internet sites, professional associations, peers and other resources to develop goals that address training, education and self-improvement issues.

ESS09.09.02 Read trade magazines and journals, manufacturers' catalogues, industry publications and Internet sites to keep current on industry trends.

ESS09.09.03 Participate in relevant conferences, workshops, mentoring activities and in-service training to stay current with recent changes in the field.

**ESS09.10 Examine licensing, certification and credentialing requirements at the national, state and local levels to maintain compliance with industry requirements.**

ESS09.10.01 Examine continuing education requirements related to licensing, certification, and credentialing requirements at the local, state and national levels for chosen occupation.

ESS09.10.02 Examine the procedures and paperwork involved in maintaining and updating licensure, certification and credentials for chosen occupation.

ESS09.10.03 Align ongoing licensing, certification and credentialing requirements to career plans and goals.

**ESS09.11 Examine employment opportunities in entrepreneurship to consider entrepreneurship as an option for career planning.**

ESS09.11.01 Describe the opportunities for entrepreneurship in a given industry.



**Manufacturing Career Cluster  
Manufacturing Production Process Development Pathway  
Knowledge and Skill Statements**

<b>Essential Topic ESS10</b>	<b>TECHNICAL SKILLS:</b> <i>Use of technical knowledge and skills required to pursue careers in all career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.</i>
<b>ESS10.01</b>	<b>Employ information management techniques and strategies in the workplace to assist in decision-making.</b>
ESS10.01.01	Use information literacy skills when accessing, evaluating and disseminating information.
ESS10.01.02	Describe the nature and scope of information management.
ESS10.01.03	Maintain records to facilitate ongoing business operations.
<b>ESS10.02</b>	<b>Employ planning and time management skills and tools to enhance results and complete work tasks.</b>
ESS10.02.01	Develop goals and objectives.
ESS10.02.02	Prioritize tasks to be completed.
ESS10.02.03	Develop timelines using time management knowledge and skills.
ESS10.02.04	Use project-management skills to improve workflow and minimize costs.
ESS10.02.03	Develop timelines using time management knowledge and skills.
ESS10.02.04	Use project-management skills to improve workflow and minimize costs.

**C. CLUSTER (FOUNDATION) KNOWLEDGE AND SKILLS**

The following Cluster (Foundation) Knowledge and Skill statements apply to all careers in the Manufacturing Cluster. Persons preparing for careers in the Manufacturing Cluster should be able to demonstrate these skills in addition to those found on the Essential Knowledge and Skills Chart.



<b>Cluster Topic MNC01</b>	<b>ACADEMIC FOUNDATIONS:</b> <i>Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.</i> <i>No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.</i>
--------------------------------	--

<b>Cluster Topic MNC02</b>	<b>COMMUNICATIONS:</b> <i>Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.</i> <i>No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.</i>
--------------------------------	--



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

**Cluster Topic**  
**MNC03**

**PROBLEM-SOLVING AND CRITICAL THINKING:** *Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.*

*No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.*

**Cluster Topic**  
**MNC04**

**INFORMATION TECHNOLOGY APPLICATIONS:** *Use information technology tools specific to the career cluster to access, manage, integrate, and create information.*

*No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.*

**Cluster Topic**  
**MNC05**

**SYSTEMS:** *Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.*

**MNC05.01**

**Summarize and explain how manufacturing businesses operate to demonstrate an understanding of key functions within organizations in the industry.**

MNC05.01.01

Identify the role and major functions of manufacturing businesses.

*Sample Indicators*

Explain the importance of manufacturing to society.

Identify the mission, major internal functions and structure of manufacturing businesses.  
Identify the customers, suppliers, and stakeholders of manufacturing businesses, their roles, and how they relate.

Explain the major competitive challenges faced by the manufacturing businesses.

Identify and describe types of manufacturing systems.

Analyze current trends in manufacturing systems.

MNC05.01.02

**Describe how manufacturing businesses manage performance.**

*Sample Indicators*

Explain how financial performance is measured.

Explain how market performance is gauged.

Explain how service and internal operations performance is determined.

Explain how compliance and performance related to health, safety, and environment are evaluated.

MNC05.01.03

**Describe how changes outside the manufacturing business impact the manufacturing business.**

*Sample Indicators*

Explain the impact of economic changes.

Explain the impact of social changes.

Explain the impact of technology changes.

MNC05.01.04

**Explain the role of risk management in reducing risks and improving performance in manufacturing businesses.**

*Sample Indicators*

Explain the objectives of risk management programs.

Explain the major types of loss exposure for manufacturing businesses.

Explain the approaches for managing organizational risks.

MNC05.01.05

**Identify the roles and functions of government in regulating and supporting manufacturing businesses.**



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

*Sample Indicators* Explain the roles in regulating domestic operations.  
Explain the roles in regulating international operations.  
Explain the roles in managing the infrastructures of manufacturing businesses.  
Explain the roles in health, safety, and environmental management.

**MNC05.02 Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.**

MNC05.02.01 Describe how manufacturing businesses manage customer relationships.

*Sample Indicators* Identify needs and requirements of internal and external customers.  
Describe customer satisfaction and fulfillment of customer requirements.

MNC05.02.02 Explain how manufacturing businesses respond to customer problems and complaints.  
Describe how planning and budgeting are used to accomplish organizational goals and objectives.

*Sample Indicators* Explain how work plans and budgets are used to allocate people and resources.

MNC05.02.03 Identify reports used to track performance and resource and explain how they are used.  
Explain how plans and budgets are revised to meet goals and objectives.

MNC05.02.03 Explain how planning is used to improve overall business performance.

*Sample Indicators* Identify and describe the most critical performance problems that manufacturing businesses typically face.  
Describe how improvements are identified.

**Cluster Topic**  
**MNC06**

**SAFETY, HEALTH AND ENVIRONMENTAL: *Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.***

**MNC06.01 Maintain safe and healthful working conditions and environment to ensure employee safety.**

MNC06.01.01 Assess workplace conditions according to specified safety and health requirements.

*Sample Indicators* Identify the types of risk of injury/illness at work.  
Identify those who are susceptible to risk of injury/illness at work.  
Describe ways to positively impact occupational safety and health.

**MNC06.02 Understand employee rights and responsibilities and employer obligations concerning occupational safety and health.**

MNC06.02.01 Demonstrate knowledge of rules and laws designed to promote safety and health and their rationale.

*Sample Indicators* Identify key rights of employees related to occupational safety and health.  
  
Identify the responsibilities of employers related to occupational safety and health.  
Explain the role of government agencies in providing a safe workplace.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

**MNC06.03 Assess types and sources of workplace hazards in order to maintain safe working conditions in a manufacturing business environment.**

MNC06.03.01 Demonstrate methods to correct common hazards following appropriate safety procedures.

*Sample Indicators* Identify and describe common hazards in the workplace.  
Identify and describe major sources of information about hazards in the workplace (e.g., MSDS, work procedures, exposure control plans, training materials, labels, and signage).  
Identify sources of combustible/flammable materials, fire and emergencies to establish a fire safe environment.  
Interpret safety signs and symbols.

**MNC06.04 Control workplace hazards in order to maintain safe working conditions in a manufacturing business environment.**

MNC06.04.01 Demonstrate safe workplace practices that promote personal and group health.

*Sample Indicators* Identify procedures necessary for maintaining a safe work area.  
Identify methods to correct common hazards.  
Identify methods for disposing of hazardous materials.  
  
Demonstrate principals of safe physical movement to avoid slips, trips, and spills.  
Inspect and use protective equipment (PPE).

**Summarize safety, health, and environmental management systems to build an understanding of compliance with governmental policies and procedures for manufacturing businesses.**

**MNC06.05**  
MNC06.05.01 Identify the major federal and state regulatory areas.

*Sample Indicators* Identify specific health and safety laws and regulations that impact manufacturing and the major topics they address.  
Identify specific environmental management laws and regulations and the major topics they address.

MNC06.05.02 Explain how government agencies ensure compliance with environmental regulations and promote improved performance.

*Sample Indicators* Provide examples of the major regulations and types of data used by government to measure and monitor performance.  
Provide examples of how manufacturing organizations ensure their compliance.  
Provide examples of consequences that manufacturing organizations suffer when they fail to comply.

MNC06.05.03 Demonstrate workplace activities that comply with safety, health, and environmental policies and procedures.

*Sample Indicators* Promote and maintain knowledge of organizational safety, health, and environmental management policies and procedures.  
Follow organizational policies and procedures.  
Educate and orient other workers.  
Maintain a safe work area.  
Identify, describe, and report workplace hazards.  
Perform and participate in regular audits and inspections.  
Provide and maintain documentation needed for compliance.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

MNC06.05.04      Conduct and participate in accident/incident investigations.  
Develop plans to improve safety performance.  
*Sample Indicators*      Use structured problem-solving process to develop improvement plans.

**Cluster Topic**      **LEADERSHIP AND TEAMWORK: Use leadership and teamwork skills in**  
**MNC07**                      **collaborating with others to accomplish organizational goals and objectives.**

*No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.*

**Cluster Topic**      **ETHICS AND LEGAL RESPONSIBILITIES: Know and understand the**  
**MNC08**                      **importance of professional ethics and legal responsibilities.**

*No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.*

**Cluster Topic**      **EMPLOYABILITY AND CAREER DEVELOPMENT: Know and**  
**MNC09**                      **understand the importance of employability skills. Explore, plan, and effectively**  
   **manage careers. Know and understand the importance of entrepreneurship**  
   **skills.**

*No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.*

**Cluster Topic**      **TECHNICAL SKILLS: Use the technical knowledge and skills required to**  
**MNC10**                      **pursue the targeted careers for all pathways in the career cluster, including**  
   **knowledge of design, operation, and maintenance of technological systems**  
   **critical to the career cluster.**

**MNC10.01**                      **Describe and employ technical skills and knowledge required for**  
   **careers in manufacturing in order to perform basic workplace**  
   **activities common to manufacturing.**

MNC10.01.01                      Demonstrate the planning and layout processes (e.g., designing, print  
reading, measuring) used in manufacturing.

*Sample Indicators*                      Read prints and use the information to play, lay out, and produce parts or products.  
MNC10.01.02                      Summarize how materials can be processed using tools and machines.

*Sample Indicators*                      Use tools and the processes of cutting, shaping, combining, forming, etc. of materials to  
MNC10.01.03                      manufacture a part or product.

MNC10.01.03                      Describe various types of assembling processes (e.g., mechanical  
fastening, mechanical force, joining, fusion bonding, adhesive bonding)  
used in manufacturing.

*Sample Indicators*                      Apply appropriate fastening or joining procedure to the design and production of a  
MNC10.01.04                      manufactured part or product.

MNC10.01.04                      Explain finishing processes (e.g., types of finishing materials, surface  
preparation, methods of application) used in manufacturing.

*Sample Indicators*                      Select a finishing process for a product appropriate to the job it must perform  
environment in which it functions, and its aesthetic appeal.

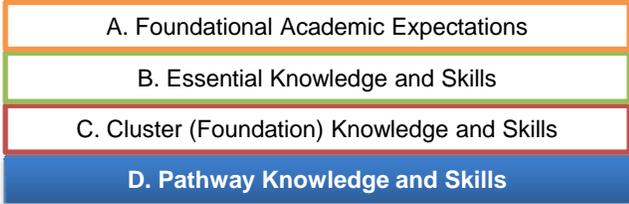


**Manufacturing Career Cluster  
Manufacturing Production Process Development Pathway  
Knowledge and Skill Statements**

MNC10.01.05 Explain the processes of inspection and quality control used in manufacturing.  
*Sample Indicators* Perform continuous on line inspections to ensure that parts or products meet design specifications.

**D. PATHWAY KNOWLEDGE AND SKILLS**

The following knowledge and skill statements apply to all careers in the Manufacturing Production Process Development Pathway. The statements are organized within nine topics.



**Pathway Topic MNPA01 CUSTOMER NEEDS**

MNPA01.01.01 Conduct in-depth investigation to identify customer needs.  
*Sample Indicators* Explain the impact of the customer's intended use of a product on every phase of the manufacturing process.  
 Meet needs of both internal and external customers.  
 Maintain liaison with customer contacts.  
 Review, maintain, and communicate customer needs and specifications.  
 Identify issues that prevent proactive handling of customer needs.

MNPA01.01.02 Verify that needed resources (capable machinery, Required Skill specification with number of persons, and capacity of the machinery) are available for the production process.  
*Sample Indicators* Use work orders when handling raw materials, while setting up tools and equipment, and when scheduling workers to maximize productivity.  
 Properly report any discrepancies related to raw materials, tools/equipment, and worker's abilities/availability.  
 Identify consequences of not reporting discrepancies in production.

MNPA01.01.03 Evaluate workers' ability to manage critical elements of the production process.  
*Sample Indicators* Evaluate workers' skills when setting up, programming, and operating equipment required for production.  
 Make proper repairs and adjustments to equipment prior to putting into service.  
 Verify that the first piece or product meets both product specifications and production capacities.  
 Examine how set-up procedures are documented for repeatability.

MNPA01.01.04 Monitor fabrication of the product using process control data.  
*Sample Indicators* Identify possible consequences resulting from failure to meet production standards.  
 Use process control data to ensure that the manufacturing process complies with standards.  
 Make the manufacturing process cycle time meet customer and business needs.  
 Identify possible consequences resulting from failure to perform operations safely.



## Manufacturing Career Cluster Manufacturing Production Process Development Pathway Knowledge and Skill Statements

	Verify that the product meets customer specifications.
	Complete, maintain, and forward to proper parties product and process documentation. Verify that production operations comply with all health, safety, and environmental policies and procedures.
MNPA01.01.05 <i>Sample Indicators</i>	<b>Inspect the product to verify that it meets specifications.</b> Verify the calibration of the testing equipment. Follow the established sampling plan and inspection policies/procedures. Predict consequences of failure to identify promptly any product and production process that do not meet specifications. Complete inspection documents accurately and forward them to proper parties. Following appropriate testing/production tools and procedures. Make adjustments needed to keep the production process within specifications. Make necessary adjustment in the manufacturing process in a timely manner.
MNPA01.01.06 <i>Sample Indicators</i>	<b>Document product and process to assure formal compliance with customer requirements.</b> Write compliance documents legibly in the appropriate format and store them in a safe, secure place.  Complete compliance documentation, obtain "sign off," and forward to the proper parties. Distinguish between products that are labeled appropriately and products that are not appropriately labeled for compliance.
MNPA01.01.07 <i>Sample Indicators</i>	<b>Check for specified quantities and proper documentation when preparing a final product for shipping or distribution.</b> Package materials to meet packaging and shipping specifications (including proper labeling). Complete package documentation and customer shipping instructions to accompany the product to the next destination. Communicate product availability to the proper parties in a timely manner. Check relevant information such as quantity, destination and packaging instructions against the work order. Verify that product is correctly stored or staged for shipping. Explain the significance of following all laws and regulations related to labeling, packaging, and transport.  Verify that material handling procedures are followed to prevent product damage.

### Pathway Topic MNPA02

## EQUIPMENT

*No additional statements in the topic beyond those found in the Cluster or Essential Knowledge and Skills Charts.*

### Pathway Topic MNPA03

## NEW MANUFACTURING PROCESSES

### MNPA03.01 **Implement new manufacturing processes to manage production of new and/or improved products.**

MNPA03.01.01 <i>Sample Indicators</i>	Research new manufacturing processes. Review current processes completely to determine any changes that are needed to meet customer requirements. Provide research to correct parties to confirm manufacturability.
--	---



## Manufacturing Career Cluster Manufacturing Production Process Development Pathway Knowledge and Skill Statements

MNPA03.01.02 <i>Sample Indicators</i>	<p>Confirm resource requirements accurately. Review project materials and processes thoroughly to establish cost estimates. Hold customer meetings to confirm customer specifications when appropriate.</p> <p><b>Create standard operating procedures (SOPs) for new process.</b> Identify new tooling and materials. Specify new training where required.</p> <p>Document new standard operating procedures according to company procedure.</p> <p>Make sure that the correct parties review all new standard operating procedures. Verify that standard operating procedures meet customer specifications including cost effectiveness.</p>
MNPA03.01.03 <i>Sample Indicators</i>	<p><b>Develop new tooling and fixtures.</b> Fabricate new tooling and fixtures according to design specifications. Properly document new tooling and fixtures development process with new material suggestions noted. Verify that new tooling and fixtures increase efficiency and cost effectiveness of the process. Verify that new tooling and fixtures result in improvement of product quality and a decrease in nonconformance.</p>
MNPA03.01.04 <i>Sample Indicators</i>	<p><b>Set up and program equipment for new processes.</b> Verify that new equipment or process works to specification and runs efficiently. Program equipment to maximize output and quality. Make sure that equipment program is concise and understandable by others. Set up equipment or process in a timely way. Continue test runs until product specifications and efficiency levels are met. Download equipment program and store correctly.</p>
MNPA03.01.05 <i>Sample Indicators</i>	<p><b>Schedule and test new processes.</b> Verify that schedules for testing new processes are complete and detailed. Follow standard procedures when making a testing schedule. Conduct review on the new process to determine readiness for implementation. Verify that testing is specific and done on a timely basis. Include data on usefulness and efficiency with documentation of test results. Obtain proper approvals to implement the changes in process determined by the test results. Use new or updated processes according to specifications.</p>
MNPA03.01.06 <i>Sample Indicators</i>	<p><b>Monitor production performance data for new processes.</b> Use up-to-date charts and available statistics to properly document monitoring. Use the proper test equipment to monitor production performance. Perform the appropriate tests based on customer or manufacturer specifications or company policy. Communicate problems effectively to proper parties. Use appropriate measurements.</p>
MNPA03.01.07 <i>Sample Indicators</i>	<p><b>Train employees on new processes.</b> Make sure that training covers appropriate material and is delivered clearly. Make sure that employees meet standards on newly trained skills. Evaluate training. Use evaluations to improve training. Verify that training records show training has been delivered. Use training to establish certification.</p>



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

MNPA03.01.08 Prepare documentation on new process according to business requirements.

*Sample Indicators*

- Make sure that documentation is complete, accurate, and legible.
- Use company procedures to complete documentation in a timely way.
- File documentation properly.
- Solicit input from workers to ensure that documentation is useful.

**Pathway Topic**  
**MNPA04 SAFETY**

**MNPA04.01 Monitor, promote and maintain a safe and productive workplace using a variety of techniques and solutions to ensure safe production of products.**

MNPA04.01.01 Perform environmental and safety inspections or coordinate with a certified agent/service to ensure conformance to all relevant local, federal and company regulations.

*Sample Indicators*

- Identify, report and monitor potential hazards in the workplace.
- Take corrective action to correct potential hazards.
- Review health, safety, and environmental documentation and policies thoroughly and regularly.
- Ensure that inspections meet all relevant, health, safety, and environmental laws and regulations.
- Completed inspections according to company schedule and procedures.
- Document inspection records and store them correctly.

MNPA04.01.02 Participate in emergency response teams.

*Sample Indicators*

- Confirm that first aid training and certification on emergency and first aid procedures are complete and up-to-date.
- Comply with company and regulatory policies and procedures to respond to emergencies.
- Document emergency drills and incidents according to company and regulatory procedures.

MNPA04.01.03 Identify unsafe conditions according to safety standards and report to proper authorities.

*Sample Indicators*

- Identify, report, and document conditions presenting a threat to health, safety, and the environment.
- Identify corrective actions.
- Consult appropriate parties/documents about corrective actions and take corrective actions following company procedures promptly.
- Track and report ongoing safety concerns until corrective action is taken.

MNPA04.01.04 Take corrective action following prescribed safety procedures.

MNPA04.01.05 Train employees in safe practices and emergency procedures through a safety orientation.

*Sample Indicators*

- Verify that all safety topics and procedures are covered in orientation.
- Observe orientation to ensure that it makes clear the need and processes for employees to raise safety concerns, ask questions, and receive additional training.
- Use company requirements to document orientation.
- Verify that orientation meets all relevant laws, policies, and regulations.
- Deliver safety instruction and updates on a regular schedule.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

<b>Pathway Topic</b>	<b>QUALITY IMPROVEMENT</b>
<b>MNPA05</b>	<b>Implement continuous improvement processes in order to maintain quality within the manufacturing production process.</b>
<b>MNPA05.01</b>	<b>Perform periodic internal quality audit activities.</b>
<i>MNPA05.01.01</i> <i>Sample Indicators</i>	Complete all audit forms correctly in a timely manner. Forward forms to the correct parties. Verify that audit data is relevant and correct. Make sure that conformances to quality standards are properly assessed and documented. Include observation of operation in audit when appropriate to ensure performance meets specifications. Follow company and other required schedules and procedures to perform audit.
<b>MNPA05.01.02</b>	<b>Monitor calibration of data collection equipment.</b>
<i>MNPA05.01.02</i> <i>Sample Indicators</i>	Follow specifications to implement calibration schedule. Review documents and use thorough observation to check instrument certification during use. Recalibrate instruments that are out of calibration or refer them to the appropriate parties for recalibration or repairs immediately.
<b>MNPA05.01.03</b>	<b>Suggest process improvements on a regular basis.</b>
<i>MNPA05.01.03</i> <i>Sample Indicators</i>	Use observations and data analysis to generate potential improvements. Verify that suggestions communicate measurable and data-driven benefits to the company, its customers, and employees. Use proper procedures and documentation to make suggestions. Make sure that all suggestions show that all data was reviewed prior to making recommendation.
<b>MNPA05.01.04</b>	<b>Inspect materials at all stages of a process to determine quality or condition.</b>
<i>MNPA05.01.04</i> <i>Sample Indicators</i>	Follow schedule and procedures to complete sampling and inspection. Select and use inspection tools and procedures correctly. Inspect materials against specifications. Identify materials that do not meet specification. Take corrective action on out-of-specification material. Document inspection results properly. Report inspection results to correct parties.
<b>MNPA05.01.05</b>	<b>Document the results of quality tests according to business requirements.</b>
<i>MNPA05.01.05</i> <i>Sample Indicators</i>	Check data forms to ensure that they are complete and accurate. Make sure that information is evaluated and interpreted correctly. Forward data to correct parties. Select and use appropriate analytical tools.
<b>MNPA05.01.06</b>	<b>Restore or maintain quality by making process adjustments.</b>
<i>MNPA05.01.06</i> <i>Sample Indicators</i>	Make sure that appropriate corrective actions are identified and approvals received when needed. Make adjustments for corrections to eliminate deviations and bring the process back into control. Make adjustments in a timely manner. Document adjustments properly.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

<b>Pathway Topic</b> <b>MNPA06</b>	<b>COMMUNICATIONS</b>
<b>MNPA06.01</b>	<b>Communicate with co-workers and/or external customers to ensure that the manufacturing production process meets business requirements.</b>
MNPA06.01.01	Communicate safety, training, and job-specific needs using speaking and presentation skills.
<i>Sample Indicators</i>	Ensure that safety issues are understood and safety practices are being used. Explain the significance of on-the-job issues and concerns being discussed and quickly resolved. Identify current and future training issues in a timely way.  Verify that communication shows knowledge of both customer and business needs. Be clear and relevant with communications related to safety, training, and job-specific needs. Communicate in a timely and accurate manner to the correct parties. Evaluate, track, and report back safety, training, and job-specific issues to original communicator.
MNPA06.01.02	Track and document communications related to safety, training, and job-specific needs. <b>Communicate material specifications and delivery schedules in a timely and accurate manner.</b>
<i>Sample Indicators</i>	Make sure that communication reflects knowledge of material specifications. Communicate delivery schedules clearly.  Make sure that communication shows knowledge of both customer and business needs.  Make sure that communication is clear and relevant to material and delivery issues. Communicate in a timely and accurate manner to the correct parties.  Evaluate, track, and report back material and delivery issues to original communicator. Track and document material specifications and delivery schedules.
MNPA06.01.03	<b>Communicate production requirements and product specifications.</b>
<i>Sample Indicators</i>	Make sure that communication reflects knowledge of production requirements, levels, and product specifications. Initiate communication to meet production requirements, product specifications, or other customer or business needs cross-functionally as required. Notify all parties of production issues and problems in a timely way.  Make sure that communication shows knowledge of both customer and business needs. Make sure that communication to production and products is clear and relevant.  Evaluate, track, and report production and product issues back to original communicator. Track and document communications related to production requirements and product specifications as appropriate.
<b>Pathway Topic</b> <b>MNPA07</b>	<b>CONTINUOUS IMPROVEMENT</b>



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

**MNPA07.01      Recommend and/or implement continuous improvement activities in order to ensure production of high quality products that meet customer expectations.**

- MNPA07.01.01      Analyze data to identify potential problems.  
*Sample Indicators*      Apply quality tools and techniques properly to determine the source of potential quality problems.  
Continuously reassess process capability.  
Validate process and product measurement systems.  
Adjust process and product measurement systems as required.  
Report quality data to appropriate parties in a timely manner.
- MNPA07.01.02      Monitor process capability.  
*Sample Indicators*      Make sure processes meet manufacturer and other quality specifications.  
Make sure processes meet company or customer capability requirements.  
Make sure that process meets on-time delivery needs of the customer.  
Report analyzed process capability data according to procedures.  
Use results of capability studies to adjust product or process.  
Distribute results of capability studies to appropriate parties.
- MNPA07.01.03      Monitor customer satisfaction.  
*Sample Indicators*      Use appropriate data to measure customer satisfaction.  
Implement surveys and other customer data techniques in a timely manner.  
Report returned goods to appropriate parties for review.  
Include vendor certifications with customer documentation.  
Document on-time delivery data appropriately.  
Review field failure and product life data in a timely manner.
- MNPA07.01.04      Measure and record product and process outcomes.  
*Sample Indicators*      Use proper format to record product and process outcomes within the specified timeframe.  
  
Use appropriate quality analysis and statistical techniques to analyze performance.  
Report outcomes to all appropriate parties.
- MNPA07.01.05      Develop new work procedures according to production needs.  
*Sample Indicators*      Translate recommendations for continuous improvement into new work instructions.  
Publish work instructions in appropriate format.  
Distribute work instruction according to standard procedures.  
Discuss new work procedures or instructions with all stakeholders to ensure support for improvements.
- MNPA07.01.06      Implement approved recommendations.  
*Sample Indicators*      Make recommendations for continuous improvement that are clear, concise, and based on data trends and patterns.  
  
Make recommendations in such a way that draws support for process improvement.  
  
Verify that all stakeholders understand their role in process improvement changes.  
Document accepted process improvements before translating into revised work processes and procedures.
- MNPA07.01.07      Compare final product specs to identified customer and business needs.  
*Sample Indicators*      Verify that final test results meet customer requirements.  
Produce product within company time and cost parameters.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

Take action to minimize negative customer feedback on quality issues.

**Pathway Topic**  
**MNPA08**      **NEW PRODUCT DEVELOPMENT**

**MNPA08.01**      **Produce a new product that meets identified customer needs to demonstrate use of manufacturing production process development strategies and techniques.**

MNPA08.01.01      Conduct research for new products.  
*Sample Indicators*      Document research and test results properly.  
Complete testing, including trial runs, on new products and services.  
Use research to modify production processes as appropriate.  
Provide research on new products to the customer for approval before producing new product.

MNPA08.01.02      Obtain required supplies according to estimated production requirements.  
  
*Sample Indicators*      Make correct supplies available at workstation.  
Communicate inventory shortages and defects effectively to correct parties.  
Check supplies against work order.  
Review supply records and history completely.

MNPA08.01.03      Produce new product by executing the appropriate process.  
*Sample Indicators*      Follow standard operating procedures.  
Meet production timeline.  
Continually check product for quality.  
Analyze production sequence for capability and efficiency.  
Perform production sequence safely.

MNPA08.01.04      Deliver product that meets specification to next production station in a timely way.  
*Sample Indicators*      **Inspect product for deviations from specifications.**  
Evaluate product quality against specifications.  
Communicate deviations from specifications effectively to correct parties.  
  
Handle out-of-specification products properly according to company procedures.  
Document inspections properly according to company procedures.  
Conduct inspections continuously.

MNPA08.01.05      Evaluate prototypes for manufacturability.  
*Sample Indicators*      Pilot test prototype for manufacturability.  
Check manufacturing plans for the prototype against existing resources.  
  
Communicate results of the evaluation effectively to correct parties in a timely way.  
Document evaluation according to company procedures.  
Solicit feedback from operators and accurately document it.  
Verify that resulting product meets customer requirements and specifications.

MNPA08.01.06      Solve production process problems utilizing problem-solving techniques.  
  
*Sample Indicators*      Document problems and suggested solutions.  
Communicate problems and solutions effectively to the correct parties.  
Solve problems with minimum downtime.  
Minimize negative impact on other workstations and the overall process while solving problems.



## Manufacturing Career Cluster Manufacturing Production Process Development Pathway Knowledge and Skill Statements

MNPA08.01.07 <i>Sample Indicators</i>	Implement approved solutions efficiently and effectively. Deliver finished product to next stage in production process. Deliver product according to schedule and customer delivery timelines. Include complete shipping records and documentation with the product. Notify customers of product status. Label package correctly.
--	--

<b>Pathway Topic MNPA09</b>	<b>PRODUCTION PROCESS</b>
---------------------------------	---------------------------

<b>MNPA09.01</b>	<b>Improve production processes in order to achieve manufacturing goals and meet customer and product standards.</b>
------------------	--

MNPA09.01.01 <i>Sample Indicators</i>	Audit production process. Collect all relevant data for the audit in a timely way. Use past production data and current production goals to evaluate audit data. Perform audits according to the proper schedule. Communicate discrepancies to the proper parties in a timely way.  Make sure that audit report is complete including all supporting data and analyses. Submit audit report according to company procedure. Verify that problems are identified.
MNPA09.01.02 <i>Sample Indicators</i>	Propose changes to improve products and processes. Make suggestions for improvement in a timely way. Verify that product quality improves. Verify that production time decreases. Follow-up on proposals containing supporting materials for justifications with correct parties. Use company procedures to make proposals. Evaluate suggestions for effectiveness. Verify that suggestions meet quality and safety standards. Document proposals properly. Implement proposed changes.
MNPA09.01.03 <i>Sample Indicators</i>	Develop production improvement goals. Set realistic and attainable goals. Make sure that goals meet technical standards. Write goals that are specific, simple, understandable, and measurable. Verify that goals are consistent with business objectives. Document goals according to company procedures. Communicate goals to correct parties in a timely way.
MNPA09.01.04 <i>Sample Indicators</i>	Inspect product for deviations from customer and product standard(s). Compare product to the correct customer and company standards. Perform inspections according to company procedures in a timely way.  Verify that inspections completely and accurately identify deviation from specifications. Document inspections properly according to customer specifications and company procedures. Conduct inspections continuously to ensure that standards are maintained throughout the process. Handle out-of-compliance product correctly according to company procedure.



**Manufacturing Career Cluster**  
**Manufacturing Production Process Development Pathway**  
**Knowledge and Skill Statements**

MNPA09.01.05

*Sample Indicators*

**Correct product or process problems.**

Make corrections immediately upon identification of a problem.

Make corrections according to company procedures.

Identify underlying or root cause of problem.

Address underlying or root cause of problem.

Test corrective actions to determine if the problem is solved.

Document problems and corrections properly.

Communicate problems and corrections effectively to correct parties.

Handle out-of-compliance product according to company procedure.

Perform any rework or remediation needed to bring product into specifications in a timely way.