A Quick Introduction to Manufacturing Production Process Development

This section includes skill standards for the manufacturing concentration of Manufacturing Production Process Development. These skill standards were developed by the Manufacturing Skill Standards Council (MSSC), under the auspices of the National Skill Standards Board (NSSB).

For a detailed explanation of each aspect of the standards, see *A Quick Orientation*, one of the guidebooks included with your binder.

Skill Standards: A Brief Explanation

The MSSC developed skill standards for six concentrations – major areas of frontline manufacturing work covering families of related jobs. The standards in this document cover the Manufacturing Production Process Development concentration. The Manufacturing Production Process Development concentration is defined as follows:

MANUFACTURING PRODUCTION PROCESS DEVELOPMENT	
DEFINITION	**SAMPLE JOBS COVERED**
Develop, implement, and improve the manufacturing process through early production and process changes. Assess product and process design for manufacturability.	Manufacturing technician, process improvement technician, and jig and fixture designer

The skill standards are made up of two major components. They are:

Information *About the Work.* This component describes what workers need to be able to do on the job to perform competently. It includes:

- *Critical Work Functions* – The major responsibilities of work within a concentration.
- *Key Activities* – The major duties or tasks involved in carrying out a critical work function.
- *Performance Indicators* – Indicators of how to determine when someone is performing each key activity competently.

Information *About the Worker.* This aspect of the skill standards describes the knowledge and skills an individual needs to perform the work described by each critical work function, along with its key activities and performance indicators. There are three types of knowledge and skills:

- *Academic Knowledge and Skills* – Academic skills such as mathematics, reading, etc.
- *Employability Knowledge and Skills* – Broadly applicable skills such as working in teams, analyzing and solving problems, etc.
- *Occupational and Technical Knowledge and Skills* – Occupational and technical skills that tend to be specific to an industry or concentration, such as skill in using inspection tools and equipment, knowledge of manufacturing processes, etc.

For the academic and employability knowledge and skills, the MSSC skill standards provide:

Complexity Ratings: These ratings tells us, for a given critical work function, the level of complexity required in a particular academic or employability knowledge and skill. For example, if writing is required in order to perform a given critical work function, the complexity rating would tell us whether someone needs to write telephone messages versus technical manuals. These ratings were developed using the NSSB Academic and Employability Skill Scales. For more information on the scales and complexity ratings, see *A Quick Orientation* and the *Skill Scales Companion Guide*. There are two types of complexity ratings in the skill standards:

Overall Complexity Rating: As the name implies, the overall complexity rating gives us a rough estimate of the overall level of complexity required for a given knowledge and skill. These ratings are provided for frontline workers (represented by the symbol "W") and first-line supervisors (represented by the symbol "S"). The scale is: **L = Low; M = Moderate; and H = High**

In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Subdimension Complexity Rating: To give users more detailed information, the MSSC skill standards also provide an individual rating for each subdimension in the NSSB Academic and Employability Skill Scale (See the *Skill Scales Companion Guide*). These ratings apply to frontline workers only. Ratings have not been developed for first-line supervisors at this time. The scale is: **L = Low; M = Moderate; and H = High**

In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Occupational and Technical Knowledge and Skills

Occupational and technical knowledge and skills are unique to a given industry sector or concentration. In manufacturing, they include knowledge and skills in areas such as inspection tools and equipment, production tools and equipment, and manufacturing processes.

The MSSC standards describe the occupational and technical knowledge and skills needed to perform each critical work function. The occupational and technical knowledge and skills are grouped into categories, with specific examples under each category. Please note that the MSSC did not develop complexity ratings for the occupational and technical knowledge and skills. This may be a part of future research.

Tips for Getting Started

Here are step-by-step instructions to help you get started:

1. Find a critical work function that interests you. Read each of its key activities, along with its associated performance indicators. You will find this information in the "About the Work" section on the left-hand page.
2. Open the fold-out pages and examine the "About the Worker" sections that focus on the academic and employability knowledge and skills.
3. Start by looking at the first academic knowledge and skill, which is always math, and find out the overall complexity rating by looking across the table to the right. To understand what this rating means, see the *Skill Scales Companion Guide*.
4. To find out the subdimension ratings for math, look further across the standards, using the *Skill Scales Companion Guide* to understand what each rating means. Repeat process for rest of academic and employability knowledge and skills.
5. Now, look at the occupational and technical knowledge and skills needed for this critical work function. These are located on the back page of the two-page fold-out section.

Critical Work Function: Improve production processes.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Conduct research for new products	All relevant data for the audit is collected in a timely way. Audit data is evaluated based on past production data and current production goals. Audits are performed according to the proper schedule. Discrepancies are communicated to proper parties in a timely way. Audit report is complete, including all supporting data and analyses. Audit report is submitted according to company procedures. Problems identified as a result of the audit are acted upon in a timely way.
Propose changes to improve products and processes	Suggestions for improvement are made in a timely way. Quality of product improves. The time to produce product decreases. Proposals, containing supporting materials for justifications, are followed up on with correct parties. Proposals are made according to company procedures. Suggestions are evaluated for effectiveness. Suggestions meet quality and safety standards. Proposals are properly documented. Proposed changes are implemented.
Develop production improvement goals	Goals are realistic and attainable. Goals meet technical standards. Goals are specific, simple, understandable and measurable. Goals are consistent with business objectives. Goals are properly documented according to company procedures. Goals are communicated to correct parties in a timely way.
Inspect product for deviations from customer and product standard(s)	Product is compared to the correct customer and company standards. Inspections are performed according to company procedures in a timely way. Inspections completely and accurately identify deviation from specifications. Inspections are properly documented according to company and customer procedures. Inspections occur continuously to ensure that standards are maintained throughout the process. Out- of- compliance product is correctly handled according to company procedure.
Correct product or process problems	Corrections are made immediately upon identification of a problem. Corrections are made according to company procedures. Underlying or root cause of problem is identified. Underlying or root cause of problem is addressed. Corrective actions are tested to determine if the problem is solved. Problems and corrections are properly documented. Problems and corrections are effectively communicated to correct parties. Out-of- compliance products handled according to company procedures. Any rework or remediation needed to bring product into specifications is performed in a timely way.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**M**	**M**	Complexity of mathematics content	Number sense and computation	**M**
				Geometry, measurement, and spatial sense	**M**
				Complexity of data analysis, statistics, and probability	**M**
				Functions and algebraic thinking	**M**
				Complexity of representation and communication	**M**
			Complexity of problem solving	Mathematical methods	**M**
				Mathematical reasoning	**M**
				Mathematical tools	**M**
Science	**M**	**M**	Complexity of scientific inquiry	Design	**M**
				Use of evidence	**M**
			Complexity of understanding the nature of science	Unifying concepts and processes	**M**
			Complexity of core scientific content	Physical science	**M**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**M**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**M**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**M**
				To inform	**M**
				To persuade	**M**
Listening	**M**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**M**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**M**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**M**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**H**	**H**	Difficulty of information gathering	Amount of information	**H**
				Number and variety of sources	**M**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**H**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**H**	**H**	Problem complexity	Problem uniqueness or difficulty	**H**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**H**
Making Decisions and Judgments	**M**	**M**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**M**	**M**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**M**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**M**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**M**
			People challenges	Coaching or monitoring needs	**M**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**M**	**M**	Need for learning and development	Self and career development requirements	**M**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**M**
				Application constraints	**M**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Experimenting, Prototyping, and Trials	A. Skill in using current manufacturing techniques to improve productivity. B. Skill in analyzing process to identify and correct problems, such as bottlenecks. C. Knowledge of new machinery and training materials. D. Knowledge of new and emerging technologies. E. Knowledge of processes used in the past.	F. Knowledge of product design and specifications to contribute continuous process improvement. G. Skill in evaluating product reliability and safety. H. Knowledge of the application of alternative materials. I. Knowledge of software applications.
Industry Awareness	A. Knowledge of company's business objectives in order to align production goals with those objectives. B. Knowledge of customer requirements.	C. Knowledge of product features and application and how they can benefit customers.
Business Policies and Procedures	A. Knowledge of company policy when making proposals to improve production process. B. Knowledge of departmental goals and objectives to ensure alignment with strategic goals and objectives. C. Skill in developing and using measurement methods to determine whether company goals are being achieved.	D. Knowledge of industrial and company standards involving handling of non-conforming product. E. Knowledge of internal audit procedures in order to comply with needed changes in process.
Statistical Tools and Systems	A. Knowledge of internal assessment methods to evaluate process. B. Knowledge of continuous improvement practices in order to make changes. C. Skill in using appropriate measurement devices to measure how well product meets specifications.	D. Knowledge of statistical methods to identify unacceptable deviation from product specifications. E. Skill in gathering data for analysis.
Quality Process	A. Knowledge of process controls used to evaluate process. B. Skill in using quality assurance checks to provide continuous improvement. C. Knowledge of inspection standards and frequency to verify that the product meets specifications. D. Knowledge of how to use quality measurements to check compliance.	E. Knowledge of the procedures to document and report non-compliance and quality assurance. F. Skill in designing tests for effectiveness of corrective action. G. Skill in basic troubleshooting to correct production problems
Manufacturing Process	A. Knowledge of how to establish realistic goals for process improvement. B. Knowledge of processes used to ensure that changes do not negatively impact production or product. C. Knowledge of production timing to ensure customer satisfaction and on-time delivery.	D. Knowledge of time and motion to enhance productivity. E. Knowledge of quality assurance checks needed to conduct inspections. F. Skill in making continuous adjustments to equipment and procedures that result in improved productivity.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Improve production processes		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	4.06	Record the corrective action taken into SOP and ISO audit via a computer
		Document production changes on PC in order to meet ISO quality standards
		Use email and fax to obtain field data
		Use email to communicate production and quality improvements to engineering
Gathering and Analyzing Information	4.14	Gather information from lean manufacturing process to analyze for possible corrective actions
		Analyze production data to generate baseline production so improvements can be measured
		Gather data on non-conforming product
		Analyze corrective action results to determine effectiveness
Analyzing and Solving Problems	4.38	Study inspection results to reduce scrap, or return to re-work
		Use root cause or critical incident analysis to determine probable cause of problems
		Anticipate quality improvements in order to calculate department's production capacity
		Identify missed production goals in order to analyze and discuss process improvements with Corrective Action Team
Making Decisions and Judgments	4.08	Decide if a proposed change to the process will benefit the customer or the company
		Determine floor space allocation to reduce bottlenecks and improve JIT flows
		Determine department goals and objectives in order to make production quality improvements
		Determine which vendors should be used for the new process
Organizing and Planning	4.14	Plan methods of suggesting improvement input
		Plan inspection schedules for proper maintenance of machinery
		Prioritize short-term schedules for lead people
		Organize data from equipment log books in order to determine line performance
Using Social Skills	3.71	Communicate non-defensively when suggesting changes to process
		Contact design engineer in a persuasive way to correct problems in product
		Contact supervisors in a professional way to suggest improvements
		Talk with co-workers respectfully when discussing opportunities for process improvements
Adaptability	3.76	Demonstrate open-mindedness regarding suggestions for improvements
		Be willing to change process when it is demonstrated to be less effective than a suggested change
		Change inspection procedures to meet the needs of new processes
Working in Teams	4.32	Work with co-workers to conduct audits on a timely basis to ensure ISO certification

Manufacturing Production Process Development
Academic and Employability Skill Examples

		Include members outside of workgroup in brainstorming sessions in an effort to add a new perspective
		Team with QA department to identify areas for quality improvement
		Work with process control team to minimize the process and reduce defects
Leading Others	3.68	Lead staff to respond to suggestions for improvement by setting the example
		Lead team members in problem solving activities
		Motivate line workers to participate in goal setting for process improvement
		Encourage co-workers to submit new ideas on how to improve a process
Building Consensus	3.94	Facilitate changes in continuous improvement by meeting with quality staff and team
		Build consensus in the correct handling and procedures of scrap material
		Facilitate agreement of team between two competing recommendations
		Build consensus on team members' responsibilities for meeting team goals
Self and Career Development	3.27	Take a course on process optimization
		Develop a training schedule for team members
		Attend training on leadership skills
Speaking	3.50	Talk with operators to gain audit information
		Present company goals at staff meeting to gain understanding from team
		Discuss proposals for changes and improvement of product with team members
		Discuss training opportunities with team in order to gain support for taking classes
Listening	4.03	Receive feedback on audit reports to ensure corrective and proper action is taken to resolve problems
		Listen to customer concerns regarding production capacity and capabilities
		Receive feedback from technicians on quality defects in order to improve process
		Listen to feedback of workers regarding recent training they attended
Writing	4.08	Submit written proposals for improvement to ensure justification for change
		Create written records for all proposals for improvement of process
		Document steps taken to improve process
		Write ISO procedures for all new processes
Reading	4.37	Read audit reports to determine corrective actions
		Read company news reports
		Read and interpret technical drawings to assure conformity of product
		Read inspection documents to ensure they adequately address production issues
Math	4.08	Develop measuring system using SPC system

		Identify cost of suggested improvement vs. ROI
		Calculate the percentage change in scrap rate to see if improvements have been made to process
		Calculate the number of rejects to determine work order yield
Science	3.70	Understand electrical load limits related to production and product size
		Knowledge of chemical reactions to identify potential hazards that need to be corrected
		Understanding of physical sciences related to process output (e.g., tensile strength, density, elongation and chemical composition)

MPPD2

Critical Work Function: Produce product to meet customer needs.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Identify customer needs	The different and common needs of internal and external customers are recognized. Customer contact about product aspects and printed specifications is maintained to ensure understanding of needs. Customer needs are reviewed on a regular basis. Customer specifications are up-to-date. Customer needs are communicated effectively to others including shift-to-shift, co-workers, and managers. Issues preventing customer needs from being met are addressed proactively.
Determine that resources such as materials, tools and equipment, are available for the production process	Raw materials are checked against work order. Tools and equipment are checked against work order. Inventory discrepancies are communicated to the proper parties. Necessary resources are at workstation when required. Workers with appropriate skills are scheduled according to production needs.
Set up equipment for the production process	Proper repairs and adjustments are made to production equipment prior to putting into service. Set-up meets process specifications of internal and external customers. First piece or production run meets specifications. Set-up procedures are documented for repeatability. Set-up meets ergonomic and other relevant health, safety, and environmental standards. Set-up meets equipment specifications.
Perform and monitor the process to make the product	Process control data indicates that the manufacturing process is in compliance with standards. Manufacturing process cycle time meets customer and business needs. Operations are performed safely. Product meets customer specifications. Product and process documentation is completed, maintained and forwarded to the proper parties. Production operations comply with all health, safety, and environmental policies and procedures.
Inspect the product to make sure it meets specifications	The calibration of the testing equipment is verified. Established sampling plan and inspection policies and procedures are followed. Product and production processes that do not meet specifications are identified promptly. Inspection documentation is completed accurately and forwarded to the correct parties. Appropriate testing and inspection tools and procedures are followed. Adjustments needed to bring the production process back into specification are identified and communicated. Necessary adjustments are performed in a timely manner.
Document product and process compliance with customer requirements	Documentation of compliance is legible. Documentation of compliance is written in the appropriate format and correctly stored. Documentation of compliance is forwarded to the proper parties. Documentation is complete and "sign off" is obtained. Products are labeled appropriately for compliance or non-compliance.
Prepare final product for shipping or distribution	Packaging materials meet packaging and shipping specifications, including proper labeling. Completed documentation of packaging and customer shipping instructions accompany the product to the next destination. Product availability is communicated to the proper parties in a timely manner. The product and all relevant information such as quantity, destination, and packaging instructions, are checked against the work order. Product is correctly stored or staged for shipping. All laws and regulations with regard to labeling, packaging, and transport are followed. Material handling procedures are followed to prevent product damage.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**L**	**L**	Complexity of mathematics content	Number sense and computation	**M**
				Geometry, measurement, and spatial sense	**L**
				Complexity of data analysis, statistics, and probability	**L**
				Functions and algebraic thinking	**NA**
				Complexity of representation and communication	**L**
			Complexity of problem solving	Mathematical methods	**L**
				Mathematical reasoning	**L**
				Mathematical tools	**M**
Science	**NA**	**L**	Complexity of scientific inquiry	Design	**NA**
				Use of evidence	**NA**
			Complexity of understanding the nature of science	Unifying concepts and processes	**NA**
			Complexity of core scientific content	Physical science	**NA**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**NA**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**L**
Writing	**L**	**M**	Complexity of text	Complexity of text	**L**
			Complexity of writing product	Type of product	**L**
				Organization	**L**
				Elaboration	**L**
			Complexity of writing process	Writing development	**L**
				To inform	**L**
				To persuade	**L**
Listening	**M**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**L**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**L**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**M**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**M**	**M**	Difficulty of information gathering	Amount of information	**M**
				Number and variety of sources	**M**
				Resourcefulness needed	**L**
			Complexity of analysis	Complexity of information and analysis	**M**
				Need to evaluate source information	**L**
				Lack of analysis guidelines	**L**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**M**	**M**	Problem complexity	Problem uniqueness or difficulty	**M**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**M**
Making Decisions and Judgments	**M**	**M**	Degree of judgment or inference required	Lack of guidance or precedents	**L**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**L**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**L**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**L**
				Lack of feedback	**L**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**L**
				Tact and sensitivity required	**M**
Adaptability	**M**	**M**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**L**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**L**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**L**
				Scope and complexity of leadership responsibility	**NA**
			People challenges	Coaching or monitoring needs	**NA**
				Conflict management needs	**M**
Building Consensus	**L**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**L**
				Ambiguity of goals	**L**
				Lack of organizational support, incentives, or consensus leadership	**L**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**L**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**M**	**L**	Need for learning and development	Self and career development requirements	**M**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**M**
				Application constraints	**M**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for s*upervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.
Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Inspection Tools and Equipment	A. Skill in using inspection equipment, including how to calibrate, what type of equipment to use, and what frequency to use.	B. Skill in using multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
Production Tools and Equipment	A. Skill in reading and interpreting gauges (i.e., analog, digital and vernier). B. Knowledge of how to determine whether additional tools need to be purchased. C. Knowledge of lubricants and coolants to make the proper selection.	D. Skill in setting up, programming, and operating the computerized control process. E. Skill in operating production equipment. F. Knowledge of equipment capabilities to maximize productivity.
Reading and Interpreting Drawings	A. Skill in interpreting technical drawings so that customer needs are met.	
Manufacturing Process	A. Skill in communicating work orders and customer needs to production crew to minimize errors and maximize understanding. B. Knowledge of manufacturing process to be used. C. Knowledge of the materials to be used. D. Knowledge of how to order materials and tools. E. Knowledge of how to use and interpret measurement devices. F. Knowledge of procedures used to perform a self-inspection. G. Knowledge of packing and shipping processes to prepare product for shipment. H. Knowledge of available processes to determine if job can be done.	I. Knowledge of machinery operation, set up and testing. J. Skill in setting up and testing machines. K. Knowledge of how to carry out non-compliance procedures. L. Knowledge of statistical methods to determine when process is out of control. M. Skill in troubleshooting process to isolate the cause of problem. N. Knowledge of how to estimate time to determine delivery schedules and cost. O. Knowledge of how to implement quality assurance principles and methods, such as ISO 9000.
Customer Awareness	A. Knowledge of how customers will use a product to confirm the product as built will meet customer needs.	
Work Orders and Documentation	A. Skill in interpreting work orders to meet customer need. B. Skill in making machine adjustments. C. Skill in reviewing order sheets to determine if on-site adjustments are needed. D. Knowledge of how to use diagrams and technical drawings. E. Skill in interpreting route sheets and operation sheets to set-up and operate machine.	F. Skill in completing a compliance tag to indicate that the sub-assembly meets the customer requirements. G. Knowledge of customer shipping instructions to determine packing requirements. H. Knowledge of available packing materials to determine the safest method of shipping the product.
Health and Safety Policies	A. Knowledge of sanitation procedures. B. Knowledge of state and federal regulatory requirements (e.g., Occupational Safety and Health Administration (OSHA). C. Knowledge of safety procedures for chemical spills. D. Knowledge of how to safely move materials.	E. Knowledge of proper use of shipping safety equipment. F. Knowledge of emergency or evacuation procedures. G. Knowledge of Personal Protective Equipment (PPE) requirements, including safety shoes, goggles and helmets.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Product the new product to meet customer needs		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	4.24	Enter results from SPC into database
		Use internet to research similar products
		Use email to communicate with design team members
		Access specifications for new product through central database
Gathering and Analyzing Information	4.37	Analyze routing procedures and check offs to ensure that new product is delivered on time
		Gather information from production planner
		Gather information from SPC data to analyze conformance
		Review customer production specifications to determine tooling requests
Analyzing and Solving Problems	4.16	Analyze inventory and shipping records to determine just-in-time delivery standards
		Analyze SPC quality control to develop corrective action
		Analyze customer requirements to determine which raw materials should be used for what product
		Analyze new tool needs in order to place orders for additional equipment
Making Decisions and Judgments	4.32	Judge if a new product meets customer specifications
		Determine corrective action steps to ensure proper production
		Determine shipping priorities necessary to meet customer needs
		Determine what machine to use for what production step
Organizing and Planning	4.30	Organize testing and evaluation of new product and process
		Plan the steps that should be taken for out-of-spec products (rework or scrap) for profitability
		Organize flow of suppliers and parts to coincide with production schedule
		Organize contingency plans by anticipating parts or staffing shortages
Using Social Skills	3.53	Contact customer in a courteous way to determine needs
		Demonstrate respect for individual contributions by involving front line workers in the planning process
		Contact production in a tactful way to discuss bottlenecks
		Discuss quality problems with operators in a respectful manner
Adaptability	3.74	Change production methods when they do not meet specifications
		Be receptive to material changes when shortages arise
		Be receptive to last minute changes introduced by a customer's evolving vision of the product
		Modify work process to work around machine failure or staffing shortage
Working in Teams	4.37	Work collaboratively with engineering supervisors to design new product
		Work with production planning team to coordinate all phases of production launch

		Work with suppliers to ensure delivery of required supplies on time
		Team with quality assurance department to inspect new product
Leading Others	3.51	Demonstrate leadership during implementation of SPC procedures
		Encourage production workers to provide meaningful feedback on process
		Lead production team to identify customer needs upfront of design and development programs
		Influence operators to follow SOPs
Building Consensus	3.57	Facilitate agreement on shipping and delivery dates with vendors
		Build consensus with supervisors and operators on new product feasibility to meet customer requirements
		Facilitate agreement on a set of specifications prior to product development
		Build consensus on the causes for non-conforming product
Self and Career Development	2.76	Obtain training on problem solving techniques
		Attend training on implementing new process
		Attend training on new manufacturing equipment
Speaking	3.53	Present research and development project to workers to gain cooperation and understanding
		Talk with customers to determine their needs
		Present research conclusions on new product to engineering
		Discuss the manufacturability of new product with operators
Listening	4.21	Receive feedback on SPC to determine problem areas with new product
		Listen to customer feedback to determine if product met their needs
		Listen to bids from suppliers to determine best deal
		Listen to new work instructions in order to implement them correctly
Writing	3.84	Write results of prototype evaluations testing
		Write purchase orders
		Document new formulas and procedures
		Log results for quality tests
Reading	4.55	Read specifications to ensure product is within SPC limits
		Read all machine specifications to set up equipment properly
		Read and follow inspection procedures
		Read product guidelines to ensure adaptability to the manufacturing process
Math	4.08	Calculate SPC studies to measure results of quality standards
		Assess profit/loss margins vs. investment of resources

		Convert work orders to materials and sub-assembly measurements
		Identify cost to produce new part
Science	3.68	Test metal for malleability before fabrication
		Test cleaning agents for adverse reactions
		Knowledge of basic chemistry to know how chemicals will react to each other during production

MPPD3

Critical Work Function: Maintain a safe and productive work area.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Perform environmental and safety inspections	Potential hazards in the work are identified, reported, monitored. Corrective action is taken to correct potential hazards. Health, safety and environmental documentation and policies are thoroughly and regularly reviewed. Inspections meet all relevant, health, safety, and environmental laws and regulations. Inspections are done according to company schedule and procedures. Inspections are documented. Inspection records are stored correctly.
Perform emergency drills and participate in emergency response teams	Training and certification on relevant emergency and first aid procedures is complete and up to date. Emergency response complies with company and regulatory policies and procedures. Emergency drills and incidents are documented promptly according to company and regulatory procedures.
Identify unsafe conditions and take corrective action	Conditions that present a threat to health, safety and the environment are identified, reported, and documented promptly. Corrective actions are identified. Appropriate parties are consulted about corrective actions. Corrective actions are taken promptly according to company procedures. Ongoing safety concerns are tracked and reported until corrective action is taken.
Provide safety orientation to other employees	Orientation covers all topics and procedures needed to facilitate employee safety. Orientation makes clear the need and processes for employees to raise safety concerns, ask questions, and receive additional training. Orientation is documented according to company requirements. Orientation meets all relevant laws, policies, and regulations. Safety training is delivered regularly.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**NA**	**L**	Complexity of mathematics content	Number sense and computation	**NA**
				Geometry, measurement, and spatial sense	**NA**
				Complexity of data analysis, statistics, and probability	**NA**
				Functions and algebraic thinking	**NA**
				Complexity of representation and communication	**NA**
			Complexity of problem solving	Mathematical methods	**NA**
				Mathematical reasoning	**NA**
				Mathematical tools	**NA**
Science	**L**	**L**	Complexity of scientific inquiry	Design	**L**
				Use of evidence	**L**
			Complexity of understanding the nature of science	Unifying concepts and processes	**L**
			Complexity of core scientific content	Physical science	**M**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**L**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**L**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**L**
				To inform	**M**
				To persuade	**L**
Listening	**M**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**L**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**L**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**L**	**L**	Complexity of technology application	Complexity of equipment or technology	**L**
				Complexity of applications	**L**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**M**	**M**	Difficulty of information gathering	Amount of information	**M**
				Number and variety of sources	**M**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**M**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**M**	**M**	Problem complexity	Problem uniqueness or difficulty	**M**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**M**
Making Decisions and Judgments	**M**	**L**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**L**
Organizing and Planning	**L**	**M**	Complexity of plans	Goal complexity or ambiguity	**L**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**L**
				Lack of feedback	**L**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**L**	**L**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**L**
Working in Teams	**L**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**L**
				Lack of clarity or stability of responsibilities	**L**
Leading Others	**L**	**M**	Work challenges	Challenges to goal attainment	**L**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**NA**
			People challenges	Coaching or monitoring needs	**NA**
				Conflict management needs	**L**
Building Consensus	**L**	**L**	Consensus process inhibitors	Number and diversity of stakeholders	**L**
				Ambiguity of goals	**L**
				Lack of organizational support, incentives, or consensus leadership	**L**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**L**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**NA**	**L**	Need for learning and development	Self and career development requirements	**NA**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**NA**
				Application constraints	**NA**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.
Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Safety Procedures	A. Knowledge of how to locate and use Material Safety Data Sheets (MSDS). B. Knowledge of company first aid or first response procedures. C. Knowledge of material handling techniques to safely move materials. D. Knowledge of how to be proactive in responding to a safety concern and document occurrences. E. Knowledge of emergency exits. F. Knowledge of various emergency alarms and procedures.	G. Knowledge of clean-up procedures for spills. H. Knowledge of Lock Out/Tag Out requirements. I. Knowledge of how to inspect work area and report possible safety risks. J. Knowledge of machine functions to determine if all safeguards are operational. K. Knowledge of safety procedures in case of smoke or chemical inhalation. L. Knowledge of procedures for handling hazardous materials.
Personal Safety	A. Skill in identifying and reporting unsafe conditions. B. Knowledge of safety issues related to hazardous materials. C. Knowledge of housekeeping needed to maintain a safe work environment.	D. Skill in determining if all safety guards are in place prior to machine operation. E. Knowledge of clothing and personal protective equipment (PPE) that should be worn to ensure safety.
Safety Policies and Regulations	A. Knowledge of basic filing procedures to properly store inspection records. B. Knowledge of safety requirements and environmental regulations related to performing inspections. C. Knowledge of policies and procedures needed to perform audits and train employees about hazardous conditions.	D. Knowledge of company safety standards for handling potential hazards. E. Knowledge of how to safely store, identify, and use hazardous materials and pressurized vessels. F. Knowledge of OSHA and other health and safety requirements as applied to the workplace.
Corrective Action	A. Knowledge of what constitutes an unsafe condition to be able to take corrective actions. B. Knowledge of required corrective action procedures.	C. Knowledge of accident documentation procedures.
Safety Training	A. Skill in developing and/or delivering safety training per guidelines.	B. Knowledge of health and safety education requirements.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Maintain a safe and productive work area		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	3.42	Input all safety and health training into data base to guarantee proper documentation
		Use computerized data collection to identify accident trends/areas that need to be evaluated for correction and elimination
		Use computers to access training programs
		Use PowerPoint presentations to conduct safety orientations
		Use computer to track safety training
Gathering and Analyzing Information	3.13	Gather, analyze and compare present safety conditions to past
		Visually inspect work area for possible safety hazards
		Collect information on safety audits and accident logs to identify improvement opportunities and corrective actions
		Gather information on who is in need of safety training
		Gather information from injury reports to determine repeated injuries from dangerous equipment in order to make corrections
Analyzing and Solving Problems	3.34	Identify safety issues to recommend corrective actions
		Select proper personnel protective equipment for the job to prevent injuries
		Analyze safety inspection reports to help implement a corrective action plan
		Identify areas or tasks where most injuries occur to suggest modifications to process, layout or job rotations in order to eliminate injuries
Making Decisions and Judgments	3.65	Decide on the list of priorities necessary for training of personnel in emergency response situations
		Determine that all safety equipment and guards are in place
		Identify unsafe conditions
		Determine if team members have the training and physical capabilities to safely complete assigned task
		Determine the frequency of safety training and drills
Organizing and Planning	3.47	Organize safety drills to ensure worker safety
		Plan and organize safety and environmental inspections in order to prevent accidents
		Plan the appropriate timing of emergency drills
		Plan emergency drills to prepare for threats to health or safety
Using Social Skills	3.55	Communicate to the production supervisor that a safety issues exists and critical process must be stopped until a remedy is found
		Interact with peers to share info on emergency drills/procedures

		Interact with new employees on importance of safe work environment in order to make a positive impact
		Give feedback to a co-worker in order to communicate a safer way to perform an operation or task
Adaptability	3.13	Change method of production to achieve safer outcomes
		Change to a new safety procedure in order to comply with new safety law requirements
		Change the production process to temporarily work around an unsafe area or condition
		Be able to respond to different types of emergencies
Working in Teams	3.58	Work with co-workers to identify and report unsafe conditions
		Work with all team members to conduct effective fire/safety/emergency drills
		Meet and discuss conditions that are thought to be unsafe in order to make everyone aware
Leading Others	3.55	Correct potential safety issues when discovered, to make co-workers aware of how issues should be addressed
		Encourage a more participative approach to safety issues
		Lead by example to show no repercussion of notification of possible unsafe conditions
		Lead others to work safely by emphasizing safe practices
		Build a common theme of "safety-first" among workers to ensure a safe work environment
Building Consensus	3.00	Explain how to correct an unsafe condition without offending the affected workers
		Review potential or existing safety concerns and build consensus by discussing potential actions needed to resolve them
		Facilitate agreement on safety procedures in order to assure entire team follows the agreed-upon process
		Create consensus upon emergency procedures and specific people's responsibilities
		Build consensus on what level of safety training is needed
Self and Career Development	2.93	Learn about hazardous material specs to prevent injury
		Attend in-house operator safety seminars
		Identify learning opportunities in environmental laws and technology to improve safety
		Acquire CPR and first-aid training
Speaking	3.48	Present safety policies and procedures to other employees in order to understand the importance of safety
		Express concerns to management about unsafe work environment
		Present accurate and cogent presentations to new hires and trainees in safety subjects
		Present safety training to co-workers when new work processes are implemented
		Discuss environmental issues with supervisor in order to avoid accidents and unsafe conditions

Manufacturing Production Process Development
Academic and Employability Skill Examples

Listening	3.44	Listen to descriptions of safety policies and procedures in order to avoid accidents
		Listen to the concerns of the employee in order to identify ergonomics improvements needed
		Receive feedback from employees as it pertains to safety in a respectful and attentive way
		Listen to employees identifying potential safety hazards and take corrective actions
Writing	3.21	Post written warnings about unsafe conditions
		Write accurate accident injury reports
		Document clear procedures for safety practices
		Document equipment safety checks in safety log book
		Document safety incident and training orientation
		Document corrective actions regarding safety
Reading	3.63	Read warning labels to identify potentially hazardous materials
		Read information on emergency procedures
		Read MSDS forms to protect self and others
		Read company safety policies and procedures
		Read machinery and product instructions in order to safely use them
		Read safety and environmental standards to perform inspections
Math	2.31	Tabulate safety incidents
		Calculate the safe volumes of contamination
		Measure the distances needed to maintain safe tolerances in the workplace
		Measure content of lead in painted surfaces
		Calculate production quantities against accident rates to ensure that demand doesn't create unsafe workplace
Science	3.21	Understanding of how the body is impacted by ergonomics in order to make workstation more comfortable and safe
		Understanding of potential chemical hazards
		Knowledge of basic electrical systems to prevent electrocution

MPPD4

Critical Work Function: Maintain quality and implement continuous improvement processes.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Conduct periodic internal quality audit activities	All audit forms are completed correctly in a timely manner. Forms are forwarded to the correct parties. Audit data is relevant and correct. Conformances to quality standards are properly assessed and documented. When appropriate, audit includes observation of operation to ensure performance meets specifications. Audit is performed in accordance with company and other required schedules and procedures.
Check calibration of gauges and other data collection equipment	Calibration schedule is implemented according to specifications. Instrument certification is checked both by reviewing documentation and through careful observation during use. Instruments that are out of calibration are immediately recalibrated or referred to the appropriate parties for recalibration or repairs.
Suggest continuous improvements	Potential improvements are generated through observation and data analysis. Suggestions are communicate measurable and data-driven benefits to the company, its customers and employees. Suggestions are made according to proper procedures and documentation. Suggestions show that all data was reviewed prior to making recommendation.
Inspect materials at all states of process to determine quality or condition	Sampling and inspection occur according to schedule and procedures. Inspection tools and procedures are selected and used correctly. Materials are inspected against correct specifications. Materials that do not meet specification are correctly identified. Corrective action is taken on out-of specification material. Inspection results are properly documented. Inspection results are reported to correct parties.
Document the results of quality tests	Data forms are checked to ensure that they are complete and accurate. Information is evaluated and interpreted correctly. Data is forwarded to correct parties. Correct analytical tools are selected and used properly.
Make adjustments to restore or maintain quality	Appropriate corrective actions are identified and approvals received when needed. Adjustments are made to eliminate deviations and bring the process back into control. Adjustments are made in a timely manner. Adjustments are properly documented.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**M**	**M**	Complexity of mathematics content	Number sense and computation	**M**
				Geometry, measurement, and spatial sense	**M**
				Complexity of data analysis, statistics, and probability	**M**
				Functions and algebraic thinking	**M**
				Complexity of representation and communication	**M**
			Complexity of problem solving	Mathematical methods	**M**
				Mathematical reasoning	**M**
				Mathematical tools	**M**
Science	**NA**	**L**	Complexity of scientific inquiry	Design	**NA**
				Use of evidence	**NA**
			Complexity of understanding the nature of science	Unifying concepts and processes	**NA**
			Complexity of core scientific content	Physical science	**NA**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**NA**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**M**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**M**
				To inform	**M**
				To persuade	**M**
Listening	**L**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**L**
			Barriers to communication	Limitations on interaction	**L**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**L**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**M**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**M**	**M**	Difficulty of information gathering	Amount of information	**M**
				Number and variety of sources	**M**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**M**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**M**	**M**	Problem complexity	Problem uniqueness or difficulty	**M**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**M**
Making Decisions and Judgments	**M**	**M**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**L**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**L**
				Tact and sensitivity required	**L**
Adaptability	**M**	**M**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**M**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**L**	**M**	Work challenges	Challenges to goal attainment	**L**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**NA**
			People challenges	Coaching or monitoring needs	**NA**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**L**	**M**	Need for learning and development	Self and career development requirements	**M**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**M**
				Application constraints	**L**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.
Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Quality Process	A. Skill in set-up and inspection to improve production and maintain quality. B. Knowledge of how to identify good products and non-conforming products. C. Skill in inspecting materials, and labeling and returning non-conforming materials. D. Knowledge of company quality assurance procedures. E. Knowledge of quality management systems and how to use them to perform quality checks.	F. Knowledge of inspections to perform and evaluate process. G. Knowledge of how to fill out inspection sheets. H. Knowledge of how to read production documents. I. Skill in interpreting test results. J. Knowledge of basic material specifications and properties to inspect materials. K. Knowledge of data from check sheets, quality charts and statistical methods charts to be able to better control process. L. Knowledge of corrective actions that need to be reported.
Quality Documentation	A. Knowledge of inspection procedures for handling non-conforming material. B. Knowledge of how to use route sheets and statistical method charts to document process.	C. Knowledge of test equipment calibration compliance. D. Knowledge of how to complete appropriate quality forms. E. Knowledge of follow-up and reporting procedures to ensure proper communications.
Continuous Improvement Process	A. Knowledge of new and advanced technology in the industry. B. Knowledge of how to collect and analyze data to recommend improvements. C. Knowledge of production system and machinery to suggest process improvements.	D. Knowledge of statistical methods charts to ensure that process is under control. E. Knowledge of which parties should be notified of recommended changes for continuous improvement. F. Knowledge of the causes of excessive waste and scrap.
Inspection Tools	A. Skill in verifying calibration of inspection equipment. B. Knowledge of how to choose the appropriate analytical methods to interpret test data. C. Knowledge of appropriate automated inspection system.	D. Skill in evaluating the characteristics of a finished product against specifications. E. Skill in using hand-held inspection devices to examine materials. F. Skill in maintaining and storing inspection tools.
Calibration	A. Knowledge of the calibration standards, requirements, and equipment.	B. Knowledge of environmental impact that affect calibration requirements.
Manufacturing Process	A. Knowledge of manufacturing processes and how equipment operates. B. Knowledge of specifications and requirements of products being produced.	C. Knowledge of procedures for handling and storing materials and products. D. Knowledge of the basic properties of the materials used in the process.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Maintain quality and implement continuous improvement processes		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	3.60	Use computer system to track gauge calibration schedules and results of quality checks
		Use CAD to design better fixtures and processes to produce quality parts in a timely fashion
		Use calculator to conduct audits and ensure product quality at different stages of the production cycle
		Use PC to create and maintain audit documentation
		Use Access data base to collect field and in-house data in order to identify failure trends and point to areas for improvement opportunities
Gathering and Analyzing Information	3.94	Gather information from product samples to monitor conformance to specifications and to determine if machine adjustments are necessary
		Verify that all fixtures, tools, blueprints, and process sheets are current and conform to latest revision
		Solicit operator inputs to resolve problems and quality improvements
		Interpret all spec charts to understand their impact on the final product
		Check all inspection equipment
Analyzing and Solving Problems	3.81	Anticipate future quality control problems and make proactive adjustments in order to maintain quality products
		Keep records of all jobs to see if all stations uphold top quality at all times
		Analyze results of quality audits and recommend changes for problem areas
		Take part in problem solving/solution implementation activities
Making Decisions and Judgments	3.91	Determine when production must be stopped if it isn't meeting specifications
		Identify the corrective action necessary to bring a process back into control
		Decide if calibration is out-of-date and when recalibration is required
		Determine when and where to inspect or audit process for quality of product or process to meet customer requirements
		Decide if a product is within tolerances
Organizing and Planning	3.53	Organize and maintain measuring equipment calibrations
		Organize team to review quality stats and brainstorm possible solutions
		Plan periodic adjustments to machinery to recalibrate due to vibration
		Schedule inspection of production at all critical stages
Using Social Skills	3.56	Conduct audits in a non-threatening manner by explaining the reason for the audit
		Meet with fellow employees and discuss business needs in a professional manner

		Communicate the importance of quality and customer satisfaction in order to maintain a competitive edge
		Communicate results of audits to employees in a tactful way to bring awareness of areas for improvement
Adaptability	3.63	Change production and inspection method to improve product quality
		Show receptivity to alternative process methods that may improve productivity and reduce scrap
		Adapt behavior to accommodate quality requirements on different lines and with different products
		Adapt to new communication technologies to assure production and quality delivery
Working in Teams	3.90	Participate with other departments in solving quality issues
		Work with all team members to develop new ideas for process improvements
		Collaborate with team members to integrate new processes and improvements
		Work on cross-functional teams to identify continuing improvement needs
Leading Others	3.52	Show co-workers production methods to improve quality and give credit to the right employee
		Lead co-workers to positive work improvement ideas and follow up on them
		Encourage co-workers to check parts for quality
		Coach a co-worker on techniques that improve quality results
		Influence line workers to take appropriate corrective actions as identified
Building Consensus	3.41	Build consensus by brainstorming all potential C.I. Projects in order to prioritize them and begin implementation
		Have all workers collectively agree what is quality, how to define it and express the theme that quality means jobs
		Work with team members to develop consensus on corrective action implementation plan
		Build consensus on the importance of inspection to determine quality or condition
		Create agreement that proper documentation of processes will help analyze areas that need improvement and provide insight on how to effect positive change
Self and Career Development	3.21	Take a course on quality tools used by the company (e.g., SPC or statistics)
		Attend classes on SPC
		Acquire skills in new quality inspection technology to improve quality
		Increase certifications to help maintain highest level of quality
Speaking	3.34	Participate in discussions/brainstorming sessions targeted at productivity and quality improvements
		Present ideas for continuous improvements calmly and clearly

		Provide feedback on work performance that will maintain and improve performance
		Express concerns regarding work processes
		Communicate to the set up person the adjustments needed to bring a process into control
Listening	3.69	Listen to the ideas of others in a non-judgmental manner to realize the greatest gain from the CI process
		Listen to the ideas of others with an open mind
		Receive feedback from supervisor on quality of work in an appropriate way
		Listen to customers to obtain knowledge of product uses
		Listen to employees' concerns over production process
		Listen to suppliers in order to gain knowledge of product development and updates
Writing	3.64	Write test records for quality control and non-conformance reports
		Fill out reject material reports clearly and precisely
		Complete audit forms
		Create detailed log of calibration of gauges and other data collection equipment
Reading	4.00	Review procedures or suggested changes to comment on their effectiveness
		Read calibration manuals and be able to implement corrective actions
		Read audit reports
		Read vendor publications and training manuals to stay apprised of current developments
		Read shift-to-shift communications to understand what stage the process is in
		Read quality test procedures to test product
Math	3.83	Use math to produce charts on department quality levels
		Perform cost/benefit analysis to determine if a CI idea is cost effective
		Determine if a part is acceptable based on actual vs. dimension/tolerance specifications
		Estimate material usage to ensure adequate supply of materials
		Calculate equipment calibration
Science	2.82	Knowledge of potential hazards of epoxy paints
		Knowledge of chemical reactions
		Understand principles of chemistry to adjust finishing processes to meet specs
		Conduct air quality test equipment calibration to ensure worker safety

MPPD5

Critical Work Function: Communicate with co-workers and/or external customers to ensure production meets business requirements.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Communicate safety, training and job-specific needs	Communication is sufficient to ensure that safety issues are understood and safety practices used. On-the-job issues and concerns are discussed and quickly resolved. Current and future training issues are identified in a timely way. Communication demonstrates knowledge of customer and business needs. Communication is clear and relevant to the situation. Communication is made in a timely and accurate manner to the correct parties. Issues are evaluated, tracked and reported back to original communicator. Communications are tracked and documented, as appropriate.
Communicate material specifications and delivery schedules	Communication reflects knowledge of material specifications. Delivery schedules are clearly communicated. Communication demonstrates knowledge of customer and business needs. Communication is clear and relevant to material and delivery issues. Communication is made in a timely and accurate manner to the correct parties. Material and delivery issues are evaluated, tracked and reported back to original communicator. Communications are tracked and documented, as appropriate.
Communicate quality requirements, issues and training	Communication reflects knowledge of quality requirements. Quality issues are raised in a timely way. Quality issues are addressed in a timely way. Communication demonstrates knowledge of customer and business needs. Communication is clear and relevant to quality. Communication is made in a timely and accurate manner to the correct parties. Quality issues are recorded, and tracked and reported back to original communicator. Communications are tracked and documented, as appropriate.
Communicate production requirements and product specifications	Communication reflects knowledge of production requirements, levels, and product specifications. Communication is initiated cross-functionally as required to meet production requirements, product specifications, or other customer or business needs. All parties are notified of production issues and problems in a timely way. Communication demonstrates knowledge of customer and business needs. Communication is clear and relevant to production and products. Issues are evaluated, tracked and reported back to original communicator. Communications are tracked and documented, as appropriate.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**NA**	**L**	Complexity of mathematics content	Number sense and computation	**NA**
				Geometry, measurement, and spatial sense	**NA**
				Complexity of data analysis, statistics, and probability	**NA**
				Functions and algebraic thinking	**NA**
				Complexity of representation and communication	**NA**
			Complexity of problem solving	Mathematical methods	**NA**
				Mathematical reasoning	**NA**
				Mathematical tools	**NA**
Science	**NA**	**L**	Complexity of scientific inquiry	Design	**NA**
				Use of evidence	**NA**
			Complexity of understanding the nature of science	Unifying concepts and processes	**NA**
			Complexity of core scientific content	Physical science	**NA**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**NA**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**M**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**M**
				To inform	**M**
				To persuade	**M**
Listening	**M**	**H**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**M**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**H**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**M**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**L**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**M**	**M**	Difficulty of information gathering	Amount of information	**M**
				Number and variety of sources	**M**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**M**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**L**	**L**	Problem complexity	Problem uniqueness or difficulty	**L**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**M**
Making Decisions and Judgments	**M**	**L**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**H**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**M**	**M**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**M**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**M**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**NA**
			People challenges	Coaching or monitoring needs	**NA**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**NA**	**L**	Need for learning and development	Self and career development requirements	**NA**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**NA**
				Application constraints	**NA**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Quality	A. Knowledge of quality concepts and how to resolve them in a way that meets business requirements. B. Knowledge of third party quality testing to ensure materials meet specifications. C. Skill in completing a non-conforming product form to get approval for proper material disposition.	D. Knowledge of material specifications. E. Skill in interpreting quality requirements, industry standards, and documentation requirements. F. Knowledge of traceable documentation.
Scheduling	A. Skill in calculating time estimates for jobs. B. Knowledge of schedules and how to access schedules of customers or suppliers.	C. Knowledge of how to complete a requisition form to order job-related material.
Safety	A. Knowledge of safety issues and practices, including Occupational Safety and Health Administration (OSHA) regulations, to take or recommend action.	B. Knowledge of how to use Material Safety Data Sheets (MSDS). C. Knowledge of company reporting forms and documents and procedures specific to safety.
Business Policies and Procedures	A. Knowledge of which company forms to use when communicating. B. Knowledge of company organizational structure to communicate with correct parties.	C. Knowledge of customer and business needs in order to communicate effectively.
Manufacturing Process	A. Knowledge of product production specifications and productivity requirements. B. Knowledge of customer requirements. C. Knowledge of order size and materials requirements.	D. Knowledge of production process to meet business requirements. E. Knowledge of material tracking and handling procedures. F. Knowledge of the basic terminology used in the workplace.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Communicate with co-workers and/or external customers to ensure production meets business requirements

Knowledge/skill	Mean Importance	Examples
Using Information and Communication Technology	3.84	Use overhead projectors and computers to train employees in the safe operation of equipment
		Use phone to communicate with customers on quality and deliver times
		Post production schedule on Excel spreadsheet to monitor and track progress to commitment
		Use phone/fax and email to relate material specifications
		Use computerized reports to share production and quality information with production workers
Gathering and Analyzing Information	3.48	Gather and analyze data on hazardous process that may become safety concern
		Communicate change orders from sales staff to production floor
		Communicate shift to shift problems and concerns to help ensure efficiency
		Gather information on product functionality and materials in order to communicate and address production needs
		Gather production quantities and stock amounts to schedule overtime
Analyzing and Solving Problems	3.57	Analyze production bottlenecks to suggest alternate plans
		Review daily quality output stats with team
		Identify possible hazards in order to eliminate time loss injury
		Analyze material needs to ensure production can be met
Making Decisions and Judgments	3.29	Determine with the customer any deviations from specs that are acceptable
		Determine what communications are needed in order to meet production requirements
		Determine the time to completion in order to move product from one station to next
		Determine cause of conflict between clients and coworkers and determine corrective action
Organizing and Planning	3.63	Plan to have operators info-share quality concerns/issues between departments and shifts
		Organize meetings in order to communicate all production requirements
		Organize training to meet the needs of the worker in order to maximize results
		Organize and plan routine communication with customers
Using Social Skills	3.94	Suggest improvements to employees using examples of how to implement them without insulting the workers
		Encourage cooperation between peers to establish good communication among operators
		Meet with contractors in a professional manner to discuss challenges
		Contact line workers in a friendly and enthusiastic manner to communicate safety and job specific needs
Adaptability	3.68	Express receptivity to shared input from co-workers
		Be flexible to ever-changing customer needs and requirements

		Quickly accommodate to changing environments and conditions in order to maintain quality and production
		Demonstrate sensitivity to customer's changing delivery schedule
Working in Teams	3.93	Meet with outside vendor to ensure that product specs and delivery times are completely understood
		Pass along information to co-workers concerning production demands issues and possible solutions
		Team with co-workers to communicate potential hazards to one another
Leading Others	3.60	Provide peer training on problem solving techniques
		Motivate employees through positive affirmations rather than intimidation and fear
		Provide recognition for work well done
		Become a spokesperson for department by evaluating areas of concern
		Provide timely feedback to an operator encountering performance problems
Building Consensus	3.41	Work with operators to collectively agree on process quality, product quality, and produce specs so that there are no differences
		Work with team to reach consensus on today's work assignments based on skills training and team member preference
		Facilitate agreement about quality, schedules and production to best format team assignments
		Resolve any performance issues in a positive manner to accomplish long-term production goals
		Create agreement by having all parties communicate regarding quality requirements and issues
Self and Career Development	2.73	Identify training courses offered by the company in order to meet with the business's requirements
		Self educate on customer and corporate goals and policies
		Share knowledge and ask for feedback from customers
		Attend training about communicating material specifications and delivery schedules
Speaking	4.00	Communicate to the set up person the adjustments needed to bring a process into control
		Communicate to other employees quality requirements and production requirements
		Present training sessions to employees on new production processes
		Give oral production reports to co-workers of other shifts or departments to maintain goals
Listening	3.77	Listen to the concerns of co-workers regarding product specifications and requirements for improvements
		Listen to concerns of staff to better provide training
		Listen to the perspective of all team members in order to see the overall view of the issue
		Receive feedback from co-workers on job performance in an appropriate way

Manufacturing Production Process Development
Academic and Employability Skill Examples

Writing	3.39	Complete a material requisition form when parts are needed
		Write change orders and document changes
		Document into quality system the defects in parts produced
		Write reports and memos to staff regarding changes in requirements
		Prepare a written schedule of work production for shipping
		Correspond during shift change to relate problems, tasks, etc. of ongoing production
Reading	3.89	Read communications written by fellow workers on corrective action to process
		Review customer product specifications and requirements and relate them back to peers
		Read RFIs and their related materials and paraphrase into specific orders/requests of co-workers and clients
		Read material specifications and delivery schedules
Math	2.93	Calculate scrap and rework data for reports
		Perform measurements to verify parts meet customer requirements
		Compare invoice to delivery
		Calculate downtime caused by part shortage
		Calculate weights of materials and delivery issues
Science	2.48	Knowledge of proper disposal of chemicals
		Understand actual needs of product in relation to the environment it will be used

MPPD6

Critical Work Function: Suggest and/or implement continuous improvement actions.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Analyze data to identify potential problems	Quality tools and techniques are properly applied to determine the source of potential quality problems. Process capability is continuously reassessed. Process and product measurement systems are validated. Process and product measurement systems are adjusted as required. Quality data is reported to appropriate parties in a timely manner.
Monitor process capability	Processes meet manufacturer and other quality specifications. Processes meet company or customer capability requirements. Process meets on-time delivery needs of the customer. Analyzed process capability data is reported according to procedures. Results of capability studies are used to adjust product or process. Results of capability studies are distributed to appropriate parties.
Monitor customer satisfaction	Appropriate data is used to measure customer satisfaction. Surveys and other customer data techniques are implemented in a timely manner. Returned goods reported to appropriate parties for review. Customer documentation includes appropriate vendor certifications. On-time delivery data is appropriately documented. Field failures and product life data are reviewed in a timely manner.
Measure and record product and process outcomes	Product and process outcomes are recorded in proper format and timeframe. Appropriate quality analysis and statistical techniques are used to analyze performance. Outcomes are reported to all appropriate parties.
Participate in making new work procedures	Recommendations for continuous improvement are translated into new work instructions. Work instructions are published in appropriate format. Work instructions are distributed according to standard procedures. New work procedures or instructions are discussed with all stakeholders to ensure support for improvements.
Implement approved recommendations	Recommendations for continuous improvement are clear, concise and based on data trends and patterns. Recommendations are made in a way that draws support for process improvement. All stakeholders understand their role in process improvement changes. Accepted process improvements are documented to translate into revised work processes and procedures.
Check that final product meets customer and business needs	Final test results meet customer requirements. Product is produced within company time and cost parameters. Negative customer feedback on quality issues is minimized.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**M**	**M**	Complexity of mathematics content	Number sense and computation	**M**
				Geometry, measurement, and spatial sense	**M**
				Complexity of data analysis, statistics, and probability	**M**
				Functions and algebraic thinking	**M**
				Complexity of representation and communication	**M**
			Complexity of problem solving	Mathematical methods	**M**
				Mathematical reasoning	**M**
				Mathematical tools	**M**
Science	**NA**	**M**	Complexity of scientific inquiry	Design	**NA**
				Use of evidence	**NA**
			Complexity of understanding the nature of science	Unifying concepts and processes	**NA**
			Complexity of core scientific content	Physical science	**NA**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**NA**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**M**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**M**
				To inform	**M**
				To persuade	**M**
Listening	**M**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**M**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**L**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**M**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**H**	**H**	Difficulty of information gathering	Amount of information	**H**
				Number and variety of sources	**H**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**M**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**M**	**M**	Problem complexity	Problem uniqueness or difficulty	**M**
				Number and range of problems	**M**
			Solution complexity	Number and complexity of possible solutions	**M**
Making Decisions and Judgments	**M**	**M**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**M**	**M**	Degree of adaptability required	Frequency of change	**M**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**M**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**L**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**M**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**NA**
			People challenges	Coaching or monitoring needs	**NA**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**M**	**M**	Need for learning and development	Self and career development requirements	**M**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**M**
				Application constraints	**M**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.
Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Quality Policy and Procedures	A. Knowledge of how to prepare reports on quality assurance of final products. B. Skill in analyzing failures in product development, production and in the field. C. Knowledge of TQM principles and methods. D. Skill in interpreting blueprints to measure part and material quality. E. Skills in using quality assurance tools, procedures, and techniques. F. Skill in designing new quality planning procedures and documents. G. Skill in using computer systems to perform analyses. H. Knowledge of how reporting systems work to communicate with appropriate parties. I. Knowledge of requirements for recording product inspections. J. Knowledge of process procedures to determine if process is being completed properly. K. Skill in interpreting testing and inspection results to improve a final product.	L. Knowledge of process documentation and flow charts to continuously improve work processes and procedures. M. Knowledge of process documentation and flow charts to participate in developing work processes and procedures. N. Knowledge of how to report on process capability to monitor quality. O. Knowledge of all parties involved in producing a specific part. P. Skill in using various kinds of tools (i.e., Statistical Process Control (SPC), process flow charts, Quality Functional Deployment, Failure Mode Effect Analysis (FMEA)). Q. Knowledge of final product criteria so that customer and business needs are met. R. Knowledge of production scheduling systems to measure performance. S. Knowledge of the procedure for communicating new processes and procedures to ensure stakeholder awareness.
Continuous Improvement Procedures	A. Skill in following preventive action request procedure to ensure adherence to requirements. B. Knowledge of how to perform process capability studies to ensure accurate data. C. Skill in verifying results to ensure revised procedures have had their intended effect.	D. Skill in using a checklist to examine parts and/or materials to determine whether they are meeting specifications and whether the process needs to be stopped if they are not. E. Knowledge of work processes and procedures to continuously improve production process. F. Knowledge of how to update procedures to ensure process changes are made. G. Knowledge of how to assess and use internal company forms to recommend new work instructions or processes.
Statistical Tools and Systems	A. Skill in using Total Quality Management (TQM) and other quality tools to identify problems and record quality issues. B. Knowledge of statistics for making accurate decisions about quality data. C. Knowledge of how to accurately troubleshoot and categorize defect types to determine root cause. D. Knowledge of how to create charts (e.g., variables and attributes) to record and analyze quality measurements from a production process to identify root causes and recommendations. E. Skill in determining accuracy and precision when using measuring equipment. F. Skill in developing performance indicators that can be readily understood by operators. G. Skill in using historical data to perform analysis.	H. Skill in using design of experiments to determine problems and corrective action while ensuring repeatability and reproducibility. I. Knowledge of Statistical Process Control (SPC) or specific quality system in place to effectively monitor sampling and statistical methods. J. Knowledge of calibration plan and procedures using current references and standards. K. Skill in developing appropriate metric charts to track process performance over time, including information on how the data is calculated, the data source, control limits and goals to have meaningful, actionable data. L. Skill in using various kinds of tools (e.g., Statistical Process Control (SPC), process flow charts, Quality Functional Deployment, Failure Mode Effect Analysis (FMEA) M. Knowledge of how to use inspection and analysis tools, equipment and procedures
Customer Awareness	A. Knowledge of what records must be maintained. B. Knowledge of customer requirements. C. Knowledge of impact of poor quality material on final product. D. Knowledge of how to respond to customer complaints and where to document those complaints.	E. Skill in identifying and labeling non-conforming materials. F. Skill in performing customer follow-up activities (i.e., surveys, reviews, warranty tracking). G. Knowledge of the importance of using customer complaints as a measure of quality.
Corrective Action	A. Skill in changing work instructions to reflect changes made as a result of corrective action. B. Skill in using design of experiment methods to identify potential solutions. C. Knowledge in interpreting customer satisfaction survey results to uncover quality problems.	D. Knowledge of customer non-conformance reports to understand trends in customer complaints. E. Knowledge of who to communicate with when goods are returned in order to address customer concerns. F. Skill in checking returned parts to verify customer complaints.
Quality Documentation	A. Skill in documenting process capability studies to plan corrective actions. B. Knowledge of documentation and data change requests to improve procedures and work flow. C. Knowledge of how to recognize data trends that require adjustments to processes.	D. Knowledge of the importance of documenting corrective action recommendations. E. Knowledge of how to record product and process outcomes properly and in a timely manner. F. Knowledge of proper format for writing new work procedures to ensure that procedures are catalogued consistently.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS *(continued)*

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Business Policies and Procedures	A. Knowledge of company strategy and planning regarding market segment, product area, target audiences, distribution channels, and brand image to help develop new procedures. B. Skill in identifying tasks and milestones to develop a logical sequence for implementing process changes. C. Knowledge of cost per piece and product schedule. D. Knowledge of the company needs and objectives to recommend continuous improvements.	E. Knowledge of the role and responsibilities of all stakeholders involved in implementing quality assurance improvements to effectively "roll out" new quality assurance work instructions. F. Knowledge of general business terminology (i.e., gross profits, net profits) to understand the cost of achieving different levels of quality. G. Skill in developing a project implementation timeline to stay focused on goals.
Calibration	A. Skill in statistical measurement systems to verify accuracy of process and product data that is reported. B. Knowledge of how to identify the measurement tool that will produce the most accurate and precise data.	C. Knowledge of measurement technology, including how to determine accuracy, precision, and tolerance trade-offs.
Training	A. Knowledge of requirements for certification for specific job functions.	
Manufacturing Process	A. Knowledge of production process, flow capacity and reliability, inventory, and schedules to modify and improve procedures. B. Knowledge of manufacturing and engineering resources planning systems to ensure completion and delivery of product on time and up to the quality standard expected. C. Knowledge of performance improvement tools and techniques and their application in the development of work procedures.	D. Skill in balancing cost, schedule, and quality trade-offs in order to satisfy customers at a minimal cost. E. Knowledge of improvement process (i.e., identification, definition, analysis, organizing and implementing solutions, and measuring results). F. Knowledge of customer requirements, such as lead-time and delivery schedule. G. Knowledge of the production process and Standard Operating Procedures (SOPs) to assess current situation and recommend new work procedures.
Customer Awareness	A. Knowledge of tools used to measure customer needs (i.e., customer surveys, a 360 degree survey, questionnaires) to improve service based on findings. B. Knowledge of how to access relevant customer satisfaction and complaint data to use this information to inform quality assurance efforts.	C. Knowledge of the link between customer complaints and quality assurance procedures to perform root cause analysis and solve issues raised by customer complaints. D. Knowledge of company objectives and customer expectations of the product to design procedure that will deliver the expected results.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Suggest and/or implement continuous improvement actions		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	4.13	Use PC to maintain quality standards
		Use planning software to develop new or revised planning
		Use email or websites to post information to customers and workers
		Use statistical software to evaluate impact of contributing variables
Gathering and Analyzing Information	4.13	Gather information from meetings in order to determine continuous improvement activities
		Use data gathered at work centers to improve individual processes
		Use TQM tools, charts, etc. to collect and analyze data
		Analyze data from previous production runs
		Review correct action log and analyze whether the corrective actions were implemented
Analyzing and Solving Problems	4.36	Use fishbone diagram to define and identify quality problems
		Identify productivity of operators in order to determine their performance and opportunities for improvement
		Identify preventive actions that may be taken to demonstrate continuous improvement as required by QS-9000 system
		Identify negative customer feedback in order to avoid repeating the same mistakes
Making Decisions and Judgments	4.22	Determine the procedures needed for process improvements in order to meet the production standards
		Judge if product visual defect warrants product not being shipped
		Decide to change SOP when current practice is leading to injuries
		Determine if continuous improvement activity meets preventive action program requirements set forth by QS-9000
		Determine best method to document work instruction to ensure quality
Organizing and Planning	3.95	Plan the SPC implementation on a machine in order to monitor the capability
		Organize inspection data to show internal customers
		Plan product audits in order to satisfy customer requirements
		Organize implementation of continuous improvement actions for accurate results
Using Social Skills	4.00	Contact other departments in a friendly way in order to get feedback on analyzing suggestions
		Suggest how to improve a production process to supervisor in non-threatening ways
		Strengthen working relations with team members by implementing their useful suggestions and engaging them in the improvement process
		Improve morale by seeking a broad range of input and respecting the effect on other stakeholders in the process

Manufacturing Production Process Development
Academic and Employability Skill Examples

Adaptability	3.45	Change work methods to meet the needs of all others who must follow procedures
		Alter improvement plans based on introduction of new information
		Change the inspection methods to meet the needs of the machine operator
		Adapt improvement plan that is not producing the predicted results
Working in Teams	4.18	Team with corrective action teams to monitor downstream process to accomplish feedback on quality of products
		Work collaboratively with production to determine sources of potential quality problems
		Work with supervisors and other cell group members to write new work procedures
		Work with operations supervision and maintenance to correct process caused by equipment
Leading Others	3.59	Lead co-workers in collecting SPC data and interpreting the meaning of the data and charts
		Influence others to take a proactive approach to implementing continuous improvements
		Lead operators to foolproof new assembly methods
		Influence workers in translating continuous improvements into new work orders
Building Consensus	3.38	Facilitate agreement on needed information to reply to customer specs in a more timely manner
		Facilitate agreement on "customer filed issue" in order to minimize product reputation
		Build agreements by scheduling meetings that will be attended by all stakeholders
		Facilitate agreements on planning in order to set standards throughout the shop
Self and Career Development	3.71	Obtain certifications in ASQ
		Attend training on TQM
		Attend training on six sigma in order to improve customer satisfaction
Speaking	4.14	Talk with purchasing department regarding trends of specific supplier in order to maintain an accurate supplier rating
		Talk with supervisors about data in the SPC chart in order to keep process in control
		Provide feedback to work crew on corrective action taken to reduce testing
		Discuss new work procedures with team to ensure proper implementation
		Report on returned goods immediately to appropriate parties to ensure quick rework of product
Listening	4.15	Listen to quality engineers to determine feedback of problem suppliers and manufacturing processes
		Listen to concerns of customers in order to address these concerns
		Receive feedback from operators on how a certain work activity could be redone to increase quality and productivity
		Listen to concerns of work team in order to suggest new work procedures

Manufacturing Production Process Development
Academic and Employability Skill Examples

Writing	3.35	Write work instructions for quality manual following QS-9000 format
		Write forms for customer documentation
		Fill out a proposal for process improvement suggestions
		Analyze data in written form in order to forward to management
		Document performance measures of the quality process
Reading	4.55	Read analyzed data in order to identify problems
		Read machine gauges to ensure process is under control
		Read current process requirements in order to develop revised processes
		Read recommendations submitted for continuous improvement by work teams in order to determine opportunities for improvements
		Read production reports
Math	3.95	Calculate the measurements for out of control conditions
		Calculate statistics in quality tools and techniques
		Estimate customer satisfaction by interpreting statistical survey results
		Estimate potential gains in process improvements
		Track production using common formulas and percents
Science	2.55	Knowledge of chemical properties in order to suggest improvements to chemical processing
		Knowledge of physical science to suggest alternatives to metal processing
		Knowledge of metals to recommend substitutions of certain components in the operations

MPPD7

Critical Work Function: Produce new product to meet customer needs.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Conduct research for new products.	Research and test results are documented properly. New products and services are completely tested including performing trial runs. Research is used to modify production processes as appropriate. Research on new products is provided to the customer for approval before producing new product.
Obtain required supplies.	Correct supplies are available at workstation. Inventory shortages and defects are effectively communicated to correct parties. Supplies are checked correctly against work order. Supply records and history are completely reviewed.
Execute process to produce new product.	Standard operating procedures are followed. Production timeline is met. Product is continually checked for quality. Production sequence is analyzed for capability and efficiency. Production sequence is performed safely. Product meeting specification is delivered to next production station in a timely way.
Inspect product for deviations from specifications.	Product quality is evaluated against specifications. Deviations from specifications are effectively communicated to correct parties. Out-of-specification products are properly handled according to company procedures. Inspections are properly documented according to company procedures. Inspections occur continuously.
Evaluate prototypes for manufacturability.	Prototype is thoroughly pilot tested for manufacturability. Manufacturing plans for the prototype are checked against existing resources. Results of the evaluation are communicated effectively to correct parties in a timely way. Evaluation is properly documented according to company procedures. Feedback from operators is solicited and accurately documented. Resulting product meets customer requirements and specifications.
Solve production process problems.	Problems, along with suggested solutions, are properly documented. Problems and solutions are effectively communicated to correct parties. Problems are solved with minimum downtime. Problems are solved with minimum negative impact on other workstations and the overall process. Approved solutions are efficiently and effectively implemented.
Deliver finished product to next stage in production process.	Product is delivered according to schedule and customer delivery timelines. Complete shipping records and documentation accompany the product. Customers are properly notified of product status. Packaging is properly labeled.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	**M**	**M**	Complexity of mathematics content	Number sense and computation	**M**
				Geometry, measurement, and spatial sense	**M**
				Complexity of data analysis, statistics, and probability	**M**
				Functions and algebraic thinking	**M**
				Complexity of representation and communication	**M**
			Complexity of problem solving	Mathematical methods	**M**
				Mathematical reasoning	**M**
				Mathematical tools	**M**
Science	**M**	**M**	Complexity of scientific inquiry	Design	**M**
				Use of evidence	**M**
			Complexity of understanding the nature of science	Unifying concepts and processes	**M**
			Complexity of core scientific content	Physical science	**M**
				Life science	**NA**
				Earth and space science	**NA**
			Complexity of applied science	Science and technology	**M**
				Science in personal and social perspective	**NA**
Reading	**M**	**M**	Complexity of text		**M**
			Complexity of reading skills		**M**
			Complexity of reading purpose		**M**
Writing	**M**	**M**	Complexity of text	Complexity of text	**M**
			Complexity of writing product	Type of product	**M**
				Organization	**M**
				Elaboration	**M**
			Complexity of writing process	Writing development	**M**
				To inform	**M**
				To persuade	**M**
Listening	**M**	**M**	Complexity of communication	Content complexity	**M**
				Demands on attention	**M**
				Communication indirectness	**M**
			Barriers to communication	Limitations on interaction	**M**
				Distractions	**M**
Speaking	**M**	**M**	Complexity of communication	Content complexity	**M**
				Tact and sensitivity required	**M**
				Communication indirectness	**L**
			Context demands	Diversity of audience	**M**
				Constraints on preparation	**M**
				Distractions	**M**
				Listener resistance	**M**
Using Information and Communications Technology	**M**	**M**	Complexity of technology application	Complexity of equipment or technology	**M**
				Complexity of applications	**M**
				Training time constraints	**M**
			Frequency of technology change	New learning required	**M**
Gathering and Analyzing Information	**H**	**H**	Difficulty of information gathering	Amount of information	**H**
				Number and variety of sources	**H**
				Resourcefulness needed	**M**
			Complexity of analysis	Complexity of information and analysis	**H**
				Need to evaluate source information	**M**
				Lack of analysis guidelines	**M**

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**H**	**H**	Problem complexity	Problem uniqueness or difficulty	**H**
				Number and range of problems	**H**
			Solution complexity	Number and complexity of possible solutions	**H**
Making Decisions and Judgments	**M**	**M**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**M**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**M**	**M**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**M**
				Resource coordination required	**M**
				Scope and effects of planning	**M**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**H**	**M**	Degree of adaptability required	Frequency of change	**H**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**H**
			Team member heterogeneity	Team diversity	**M**
			Goal or role ambiguity	Lack of clarity or support for team goals	**M**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**M**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**M**
			People challenges	Coaching or monitoring needs	**M**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**NA**	**M**	Need for learning and development	Self and career development requirements	**NA**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**NA**
				Application constraints	**NA**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Experimenting, Prototyping, and Trials	A. Skill in using information and feedback from operators to evaluate process and product for manufacturability. B. Knowledge of process control hardware and software. C. Skill in establishing timeline and method for measuring conformance to timeline. D. Skill in using process control hardware and software to test trial run. E. Skill in performing cost analysis for justification of manufacturability. F. Skill in using precision measuring equipment, such as cmm, micrometer, caliper, and comparator, to check specification of product. G. Skill in managing cost of production to meet a pre-specified budget.	H. Knowledge of conversion process from prototype to production level. I. Knowledge of efficient manufacturing systems to maximize capability and efficiency. J. Skill in developing jigs and fixtures for set-up to test product production capability. K. Knowledge of the application of regulatory guidelines (e.g., ASTM, OSHA, MSDS) L. Knowledge of design engineering prototype concepts and methods.. M. Knowledge of new product's compatibility with existing products in order to know which existing equipment can be used.
Statistical Tools and Systems	A. Knowledge of data, graphs and charts to track trends and deviations and identify problems. B. Knowledge of appropriate documentation standards (i.e., ISO) used to ensure product meets customer requirements and specifications. C. Knowledge of quality assurance methods used to check product compliance to customer standards.	D. Skill in checking product compliance using measurement devices (i.e., micrometer, gauges and calipers). E. Skill in evaluating production process line problems to determine corrective action in a timely manner. F. Knowledge of statistical packages for measuring variability of product and enhance production. G. Skill in setting up quality sampling programs.
Materials Handling	A. Knowledge of shipping details to check accuracy against routing slip, labels and product package. B. Skill in following manufacturing router to make sure products and materials get to correct work center. C. Knowledge of how to check the accuracy of the bill of material, compared to the work order. D. Skill in completing purchase requisitions to specifications for obtaining required supplies. E. Knowledge of inventory system to obtain correct supplies for the workstation.	F. Skill in using a technology to track parts in inventory. G. Knowledge of material handling process in order to meet delivery requirements. H. Knowledge of necessary supplies to make sure they are available. I. Knowledge of how to interpret supply and inventory documents to determine adequacy of supply. J. Skill in obtaining required supplies of quality raw materials. K. Knowledge of procurement steps necessary to obtain required supplies.
Manufacturing Process	A. Knowledge of chemical capability to produce repeatable results and MSO compliance. B. Knowledge of raw materials. C Knowledge of production process in order to troubleshoot problems. D. Skill in making appropriate equipment changes and setups to effectively reduce production time. E. Knowledge of work center capabilities to determine manufacturability of product. F. Knowledge of equipment and resources to see if the company has the capability to produce the product. G. Knowledge of types of machines in order to produce the right product. H. Skill in ensuring specification sheet coincides with actual prototype production to prevent improper production processes.	I. Knowledge of manufacturing processes to achieve an appropriate on-time delivery. J. Skill in interpreting production routing sheets to determine if production sequence is performed efficiently and properly. K. Knowledge of available engineering resources in order to implement design modifications to the product. L. Skill in working with problems in order to maximize production progress. M. Knowledge of process equipment to implement preventive maintenance programs N. Skill in applying preventive maintenance programs to enhance productivity. O. Knowledge of how to design a pilot to test for manufacturability.
Industry Awareness	A. Knowledge of costs and pricing for competing products. B. Knowledge of new product's compatibility with existing products to identify marketability.	C. Knowledge of target population to determine potential customer base. D. Knowledge of market and industry standards for the product being developed.
Quality Process	A. Knowledge of vendor capability to provide on-time deliveries and quality. B. Knowledge of industry standards to check against company specifications. C. Knowledge of currently acceptable documentation and quality standards (i.e., ISO and QS 9000) D. Knowledge of quality assurance concepts and procedures. E. Skill interpreting product specifications to establish quality assurance specifications.	F. Skill in establishing Standard Operating Procedures (SOPs) for quality control. G. Knowledge of appropriate measuring devices to determine that specifications are met. H. Knowledge of company and department Standard Operating Procedures (SOPs) to ensure consistent quality of product. I. Skill in reading blueprints to determine if product meets specifications. J. Knowledge of quality system to determine how to handle defective parts.
Scheduling	A. Knowledge of time-to-market goals in order to schedule production. B. Skill in interpreting delivery schedules to get product to customer according to plan. C. Skill in establishing and interpreting a timeline to ensure production is correctly scheduled.	D. Knowledge of how long processes will take to make accurate shipping predictions. E. Knowledge of inventory control program (i.e., SAP, AS 400) to ensure availability of parts and supplies necessary for production.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Product the new product to meet customer needs		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	4.24	Enter results from SPC into database
		Use internet to research similar products
		Use email to communicate with design team members
		Access specifications for new product through central database
Gathering and Analyzing Information	4.37	Analyze routing procedures and check offs to ensure that new product is delivered on time
		Gather information from production planner
		Gather information from SPC data to analyze conformance
		Review customer production specifications to determine tooling requests
Analyzing and Solving Problems	4.16	Analyze inventory and shipping records to determine just-in-time delivery standards
		Analyze SPC quality control to develop corrective action
		Analyze customer requirements to determine which raw materials should be used for what product
		Analyze new tool needs in order to place orders for additional equipment
Making Decisions and Judgments	4.32	Judge if a new product meets customer specifications
		Determine corrective action steps to ensure proper production
		Determine shipping priorities necessary to meet customer needs
		Determine what machine to use for what production step
Organizing and Planning	4.30	Organize testing and evaluation of new product and process
		Plan the steps that should be taken for out-of-spec products (rework or scrap) for profitability
		Organize flow of suppliers and parts to coincide with production schedule
		Organize contingency plans by anticipating parts or staffing shortages
Using Social Skills	3.53	Contact customer in a courteous way to determine needs
		Demonstrate respect for individual contributions by involving front line workers in the planning process
		Contact production in a tactful way to discuss bottlenecks
		Discuss quality problems with operators in a respectful manner
Adaptability	3.74	Change production methods when they do not meet specifications
		Be receptive to material changes when shortages arise
		Be receptive to last minute changes introduced by a customer's evolving vision of the product
		Modify work process to work around machine failure or staffing shortage
Working in Teams	4.37	Work collaboratively with engineering supervisors to design new product
		Work with production planning team to coordinate all phases of production launch

		Work with suppliers to ensure delivery of required supplies on time
		Team with quality assurance department to inspect new product
Leading Others	3.51	Demonstrate leadership during implementation of SPC procedures
		Encourage production workers to provide meaningful feedback on process
		Lead production team to identify customer needs upfront of design and development programs
		Influence operators to follow SOPs
Building Consensus	3.57	Facilitate agreement on shipping and delivery dates with vendors
		Build consensus with supervisors and operators on new product feasibility to meet customer requirements
		Facilitate agreement on a set of specifications prior to product development
		Build consensus on the causes for non-conforming product
Self and Career Development	2.76	Obtain training on problem solving techniques
		Attend training on implementing new process
		Attend training on new manufacturing equipment
Speaking	3.53	Present research and development project to workers to gain cooperation and understanding
		Talk with customers to determine their needs
		Present research conclusions on new product to engineering
		Discuss the manufacturability of new product with operators
Listening	4.21	Receive feedback on SPC to determine problem areas with new product
		Listen to customer feedback to determine if product met their needs
		Listen to bids from suppliers to determine best deal
		Listen to new work instructions in order to implement them correctly
Writing	3.84	Write results of prototype evaluations testing
		Write purchase orders
		Document new formulas and procedures
		Log results for quality tests
Reading	4.55	Read specifications to ensure product is within SPC limits
		Read all machine specifications to set up equipment properly
		Read and follow inspection procedures
		Read product guidelines to ensure adaptability to the manufacturing process
Math	4.08	Calculate SPC studies to measure results of quality standards
		Assess profit/loss margins vs. investment of resources

		Convert work orders to materials and sub-assembly measurements
		Identify cost to produce new part
Science	3.68	Test metal for malleability before fabrication
		Test cleaning agents for adverse reactions
		Knowledge of basic chemistry to know how chemicals will react to each other during production

MPPD8

Critical Work Function: Implement new manufacturing processes.

Critical work functions *describe the major responsibilities involved in carrying out a concentration*

Concentrations *are the major areas of front-line work covering families of related jobs. Separate standards were identified for each concentration.*

Key Activities **Key activities** *are the duties and tasks involved in carrying out a critical work function*	Performance Indicators **Performance indicators** *correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently*
Research the new manufacturing process.	Current processes are completely reviewed to determine any changes that are needed to meet customer requirements. Research is provided to correct parties to confirm manufacturability. Resource requirements are accurately confirmed. Project materials and processes are thoroughly reviewed to establish cost estimates. When appropriate, customer meetings are held to confirm customer needs.
Create standard operating procedures (SOPs) for new processes.	New tooling and materials are identified. New training is specified where required. New standard operating procedures are documented according to company procedure. New standard operating procedures are reviewed by the correct parties. Standard operating procedures meet customer needs, including cost effectiveness.
Develop new tooling and fixtures.	New tooling and fixtures are fabricated according to design specifications. New tooling and fixture development process is properly documented with new material suggestions noted. New tooling and fixtures increase efficiency and cost effectiveness of the process. New tooling and fixtures result in improvement of product quality and a decrease in nonconformance.
Set up and program equipment for new processes.	New equipment or process works to specification and runs efficiently. Equipment is programmed to maximize output and quality. Equipment program is concise and understandable by others. Equipment or process is set up in a timely way. Test runs continue until product specifications and efficiency levels are met. Equipment program is downloaded and stored correctly.
Schedule and test new processes.	Schedules for testing of new processes are complete and detailed. Standard procedures are followed in scheduling of testing. Reviews are conducted on the new process to determine readiness for implementation. Testing is specific and done on a timely basis. Documentation of test results includes data on usefulness and efficiency. Proper approvals are obtained to implement changes in process based on test results. New or updated processes are used according to specifications.
Monitor production performance data for new processes.	Monitoring is properly documented with up-to-date charts and statistics available. The proper test equipment is used to monitor production performance. The appropriate tests are performed based on customer or manufacturer specifications or company policy. Problems are communicated effectively to proper parties. Proper measurements are used.
Train employees on new processes.	Training covers appropriate material and is delivered clearly. Employees meet standards on newly trained skills. Training is evaluated. Evaluations are used to improve training. Training records show training has been delivered. Training is used to establish certification.
Prepare documentation on new processes	Documentation is complete, accurate, and legible. Documentation is completed according to company procedures in a timely way. Documentation is properly filed. Input is solicited from workers to ensure that documentation is useful.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Math	M	M	Complexity of mathematics content	Number sense and computation	M
				Geometry, measurement, and spatial sense	M
				Complexity of data analysis, statistics, and probability	M
				Functions and algebraic thinking	M
				Complexity of representation and communication	M
			Complexity of problem solving	Mathematical methods	M
				Mathematical reasoning	M
				Mathematical tools	M
Science	M	M	Complexity of scientific inquiry	Design	M
				Use of evidence	M
			Complexity of understanding the nature of science	Unifying concepts and processes	M
			Complexity of core scientific content	Physical science	M
				Life science	NA
				Earth and space science	NA
			Complexity of applied science	Science and technology	M
				Science in personal and social perspective	M
Reading	H	M	Complexity of text		H
			Complexity of reading skills		H
			Complexity of reading purpose		M
Writing	M	H	Complexity of text	Complexity of text	H
			Complexity of writing product	Type of product	H
				Organization	H
				Elaboration	M
			Complexity of writing process	Writing development	M
				To inform	M
				To persuade	M
Listening	M	M	Complexity of communication	Content complexity	M
				Demands on attention	M
				Communication indirectness	M
			Barriers to communication	Limitations on interaction	M
				Distractions	M
Speaking	M	M	Complexity of communication	Content complexity	H
				Tact and sensitivity required	M
				Communication indirectness	M
			Context demands	Diversity of audience	M
				Constraints on preparation	M
				Distractions	M
				Listener resistance	M
Using Information and Communications Technology	M	M	Complexity of technology application	Complexity of equipment or technology	M
				Complexity of applications	H
				Training time constraints	M
			Frequency of technology change	New learning required	M
Gathering and Analyzing Information	H	H	Difficulty of information gathering	Amount of information	H
				Number and variety of sources	H
				Resourcefulness needed	M
			Complexity of analysis	Complexity of information and analysis	H
				Need to evaluate source information	M
				Lack of analysis guidelines	M

ACADEMIC AND EMPLOYABILITY SKILLS

Skill	Overall Complexity Rating for Workers	Overall Complexity Rating for Supervisors	Complexity Dimension	Complexity Subdimension	Complexity Subdimension Rating for Workers
Analyzing and Solving Problems	**H**	**H**	Problem complexity	Problem uniqueness or difficulty	**H**
				Number and range of problems	**H**
			Solution complexity	Number and complexity of possible solutions	**H**
Making Decisions and Judgments	**H**	**H**	Degree of judgment or inference required	Lack of guidance or precedents	**M**
				Integration difficulty	**M**
				Quantity or ambiguity of risks and consequences	**H**
			Individual decision-making responsibility	Accountability and autonomy	**M**
				Absence or ambiguity of rules or policy constraints	**M**
Organizing and Planning	**H**	**H**	Complexity of plans	Goal complexity or ambiguity	**M**
				Flexibility required	**H**
				Resource coordination required	**H**
				Scope and effects of planning	**H**
			Constraints on planning	Lack of guidelines	**M**
				Lack of feedback	**M**
				Constraints on resource availability	**M**
Using Social Skills	**M**	**M**	Complexity of social interactions	Diversity	**M**
				Structure or protocol required	**M**
				Tact and sensitivity required	**M**
Adaptability	**H**	**H**	Degree of adaptability required	Frequency of change	**H**
			Difficulty of adapting	Unpredictability of change	**M**
				Lack of support for change	**M**
Working in Teams	**M**	**M**	Degree of collaboration required	Task interdependence	**H**
			Team member heterogeneity	Team diversity	**H**
			Goal or role ambiguity	Lack of clarity or support for team goals	**M**
				Lack of clarity or stability of responsibilities	**M**
Leading Others	**M**	**M**	Work challenges	Challenges to goal attainment	**M**
				Work structuring requirements	**M**
				Scope and complexity of leadership responsibility	**M**
			People challenges	Coaching or monitoring needs	**M**
				Conflict management needs	**M**
Building Consensus	**M**	**M**	Consensus process inhibitors	Number and diversity of stakeholders	**M**
				Ambiguity of goals	**M**
				Lack of organizational support, incentives, or consensus leadership	**M**
				High consensus standard	**M**
			Difficulty of issues requiring consensus	Complexity of issues	**M**
				Contentiousness of issues	**M**
				Lack of opportunities for agreement	**M**
Self and Career Develop-ment	**M**	**M**	Need for learning and development	Self and career development requirements	**M**
			Limitations on learning and development opportunities	Time, resource, or support constraints	**M**
				Application constraints	**M**

Overall complexity ratings: The *overall* level of complexity required in a skill in order to perform the critical work function. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. Two separate ratings are provided: one for *workers* (entry-level up to first-line supervisors) and the other for *supervisors* (first-line supervisors). In some cases, the overall complexity rating was **NA (Non-Applicable)**. This means that this skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Complexity Subdimension ratings: These are complexity level ratings for individual aspects of the particular skill. *Scale*: H=high complexity; M=moderate complexity; and L=low complexity. At this time, these ratings are provided for workers only. In some cases, the subdimension complexity rating was **NA (Non-Applicable)**. This means that this *particular dimension* of the skill was deemed not to be needed to perform this given critical work function, so no complexity rating was assigned.

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Statistical Tools and Systems	A. Skill in using statistics tools (e.g. Statistical Process Control) to conduct a comparative study of old processes vs. new processes to show where improvements have been made. B. Knowledge of testing equipment to select proper equipment to monitor process. C. Knowledge of how to use flow charts and other documentation to create new processes. D. Knowledge of statistical tools (e.g. Statistical Process Control) to monitor production performance. E. Skill in developing a cost/time study to determine performance standards.	F. Skill in interpreting whether test results indicate that process is working properly. G. Skill in using statistical methods to determine optimal production configurations (e.g. Taguschi Methods) H. Knowledge of process control programming in order to optimize production. I. Knowledge of how to interpret and carry out measurement requests as needed or described on a work order or routing slip. J. Skill in instituting quality assurance tests for new testing procedures. K. Skill in interpreting data in charts and statistics to improve operating efficiency.
Business Policies and Procedures	A. Knowledge of appropriate standards to document process procedures. B. Knowledge of outside vendor operations and lead times to develop timeline for the internal process.	C. Knowledge of company approval process required to implement changes in product or process.
Safety Procedures	A. Knowledge of ergonomics to meet safety and ergonomic standards set by the Occupational Safety and Health Administration (OSHA). B Knowledge of safety procedures and company policies to ensure employees are properly trained.	C. Knowledge of company plan for implementing emergency response procedures. D. Knowledge of procedures for dealing with hazardous conditions in the workplace.
Training	A. Knowledge of how to solicit input from workers. B. Skill in training personnel in new processes to ensure proper process implementation. C. Skill in evaluating the effectiveness and adequacy of training. D. Skill in evaluating an individual's competency in performing tasks. E. Knowledge of training tracking systems to ensure that employees receive appropriate training.	F. Knowledge of skills and competencies required for position placement. G. Knowledge of how to use feedback techniques to help an individual improve his or her skills. H. Knowledge of how to provide on-the-job training to other employees. I. Skill in evaluating employee competency to operate the process and equipment.
Experimenting, Prototyping, and Trials	A. Skill in using CAM and other production processing software to ensure quality manufacturing processes. B. Skill in communicating with external customer to clarify their needs. C. Knowledge of tool specification requirements to produce new tooling or make other needed equipment changes. D. Knowledge of manufacturing processes to ensure design for manufacturability.	E. Knowledge of product specification in order to achieve or enhance efficiency levels. F. Knowledge of material properties testing to include destructive and non-destructive testing to determine readiness for implementation (i.e. strength, cycle, durability, quality checks) G. Knowledge of changeover and set-up procedures for "proof for production" of new processes. H. Skill in experimenting with tooling and dies to improve efficiency.
Manufacturing Process	A. Knowledge of machine and process capabilities to implement new processes. B. Skill in interpreting specifications to make adjustments. C. Knowledge of preventive maintenance procedures.	D. Knowledge of material handing techniques. E. Skill in interpreting manufacturing data and customer data to determine new tooling requirements.
Documentation	A. Knowledge of appropriate company and industry-wide standards to document manufacturing processes. B. Skill in producing clear and legible documentation. C. Skill in designing product test reports to capture data needed to meet company report requirements. D. Knowledge of internal documentation procedures to record part specifications and chain of custody in manufacturing process assurance. E. Knowledge of quality assurance checks to determine that the documentation packets are completed and maintained.	F. Knowledge of project timelines to coordinate production testing schedule with all departments. G. Skill in documenting step-by-step, sequential processes (e.g., ISO procedures) to be used as a training or reference document. H. Knowledge of the filing procedures for process information and file retrieval systems available to resolve discrepancies. I. Knowledge of computer applications for storage and retrieval of manufacturing process control information and software.
Tools, Tooling and Equipment	A. Knowledge of tool and die making to develop the new tools required for the product. B. Knowledge of machine tools to make sure equipment has the correct tooling. C. Skill in using CAM and simulation software to create new tooling and fixtures. D. Skill in fabricating tools to increase efficiency and cost effectiveness.	D. Skill in improving fixture design to improve product quality and speed product design. E. Knowledge of resource availability (i.e., equipment, personnel) to implement new processes. F. Knowledge of equipment capabilities. G. Knowledge of tooling design methods.

Manufacturing Production Process Development
Academic and Employability Skill Examples

Critical Work Function: Implement new manufacturing processes		
Knowledge/skill	**Mean Importance**	**Examples**
Using Information and Communication Technology	4.32	Use Genesis to conduct quality checks
		Access tooling materials list on PC
		Document test results on PC program
		Email production test schedule to relevant personnel
Gathering and Analyzing Information	4.11	Gather information from tool lab and analyze the need for machine realignment
		Gather information regarding new tools needed for production
		Gather information from quality sampling data to determine if quality standards have been met
		Gather information from similar processes in order to modify them for new process
Analyzing and Solving Problems	4.24	Study new procedures and process to determine if new tool fabrication is needed
		Analyze results of quality checks in order to implement needed corrections
		Analyze production flow to determine best method for material movement
		Analyze prior problems in process to result in a smoother transition to new process
Making Decisions and Judgments	4.05	Determine training needed to expedite process
		Decide what to include in the Standard Operating Procedures
		Decide what force and load are needed when building tooling and fixtures
		Determine timeline for testing new process in order to ship products to customer on time
Organizing and Planning	4.22	Organize set up procedures to ensure proper Standard Operating Procedures
		Plan SPC schedule to ensure quality control of new process
		Plan training and evaluation methods to ensure strong performance
		Organize the fabrication of new test fixtures in accordance with established timelines
Using Social Skills	3.39	Courteously work with customers who are observing the production process
		Interact with new workers in a helpful manner to show them the new process
		Interact with employees courteously to evaluative production performance
Adaptability	3.74	Modify SOPs based on new processes
		Provide cross training to co-workers in order to cover for staffing shortages
		Adapt layout of existing workstations to meet the requirements of new processes
Working in Teams	4.28	Work with HR department to set up necessary training on new process
		Work in a team to develop SOPs
		Work in a cross-department team to evaluate all aspects of the new process

Manufacturing Production Process Development
Academic and Employability Skill Examples

Leading Others	3.81	Lead staff in following SOPs
		Lead staff in their understanding of the procedures
		Motivate others to implement new production process accurately
		Coach co-workers when there is a dip downward in quality
Building Consensus	3.64	Hold customer meetings to reach consensus on customer requirements
		Develop a set of agreed upon standards needed for training
		Facilitate agreement on SOPs with management
		Resolve personal conflicts between team members
Self and Career Development	3.17	Attend training needed to improve manufacturing process, such as CNC
		Identify learning opportunities through training evaluations
		Volunteer to act as a trainer in a new process
		Identify necessary certifications for new process and then obtain them
Speaking	3.69	Provide verbal feedback on new production process
		Provide feedback on usefulness of new equipment and fixtures
		Communicate process bottlenecks to supervisors
		Discuss production process with operators and assembler to evaluate effectiveness of process
Listening	3.89	Listen to staff regarding training needs
		Listen to operator feedback regarding new equipment needs
		Listen to operator feedback when developing SOPs
		Listen to the concerns of QA department regarding the new inspection processes
Writing	4.16	Write tooling measurement specifications
		Create detailed work order for new product processes
		Take notes during customer meetings to capture all suggestions and reactions to the process
		Create Standard Operating Procedures
Reading	4.42	Read testing results and evaluations to determine effectiveness of new process
		Read and follow SOPs
		Read and interpret specifications for new product
		Read and follow programming instructions for equipment
Math	3.74	Calculate production time/productivity to determine profitability of new process
		Calculate tolerances for machine set up
		Calculate the force and strength necessary for new tooling
		Calculate averages of audit results to determine pass/fail

Science	3.62	Apply principles of physics to new equipment
		Knowledge of how process change may affect physical properties of raw materials or finished product
		Knowledge of ergonomics in order to design new tooling and fixtures