Duties and Standards

for

Metalforming Skills

Stamping Level II

Approved by:

The
National Institute for Metalworking Skills

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The principal author of this skill standards booklet is Robert W. Sherman, Executive Director of the National Institute for Metalworking Skills. The technical guidance in developing this standard has been provided by the members of the Metal Stamping Division of the Precision Metalforming Association. A significant contribution to the development, editing and final validation of these standards has been made by Charles E. Trott of Northern Illinois University. We also wish to acknowledge Brian Keefe of Northern Illinois University for his assistance in developing the early drafts.

Metalforming Skills: Stamping Level II

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Overview – Metalworking and the Skill Standards Process

The metalworking industry is fundamental to maintaining a productive industrial capacity in the United States. The industry produces everything from the simplest die or metal mold for plastics to the most sophisticated automated production lines. It designs and builds special tools, dies, jigs, fixtures, molds, diecasting dies, gages, special machinery, wire and spring products, and it bends, stamps, and forms metals to produce precision parts or components. Virtually every manufacturing and service industry draws on or depends upon the skills, capabilities, and products of the metalworking industry.

Because the quality and vitality of the metalworking industry undergirds the industrial capacity of any country, precision metalworking occupations are central to maintaining a high-wage and high-skill employment base. The metalworking industry has sought to assure that those individuals who would seek to enter into or advance within the industry have opportunity to know and develop the skills which are required. This begins with the writing of skill standards.

Skill standards describe the work duties in an industry. These standards or descriptions define a desired level of performance and identify the knowledge, skills and abilities an individual needs to perform successfully in a workplace. Skill standards focus on the common duties and their performance requirements in the various sub-industries that make up the industry.

Skill standards have been written for duties and occupational responsibilities for several metalworking processes. A complete list is found in Appendix F. These standards are based on physical job requirements and employer needs along with the comparison skills in mathematics, communications, and the knowledge needs of related metalworking theory.

The skill standards in metalworking are based on input from workers, employers, trainers, and educators nationwide. Benchmarked to those of Germany, Japan, and other leading metalworking countries, the standards are proposed for broad application in all public and private workforce development programs that prepare youth and adults for employment in metalworking occupations. The standards are also intended for application in upgrading and retraining programs, apprenticeships for those already employed in metalworking companies, and are recommended for benchmarking company-based training programs.

Individuals seeking to master skill standards have opportunities to do so through the credentialing and certification programs offered by the National Institute for Metalworking Skills, Inc. (NIMS). NIMS is a not-for –profit organization that has responsibility to write and maintain skill standards for the different occupational areas within the metalworking industry. NIMS also develops and administers credentialing tests leading to a certification of skills. Such certification offers portability to the workers, as the skill standards are the same throughout the United States in the respective occupational areas.

NIMS represents nearly all aspects of the metalworking industry and trades. Actively participating in NIMS are the following organizations.

American Machine Tool Distributors Association (AMTDA)
AMT – The Association for Manufacturing Technology
Center for Workforce Democracy, AFL-CIO
The Council of Great Lakes Governors (CGLG)
International Association of Machinists and Aerospace Workers (IAMAW)
The National Tooling and Machining Association (NTMA)
Precision Machined Products Association (PMPA)
Precision Metalforming Association (PMA)
The Society of the Plastics Industry (SPI)
Tooling and Manufacturing Association (TMA)

Several states and training programs, both public and private, are also involved with NIMS.

Mastering the skills in any of the metalworking clusters offers rewarding careers, the opportunities of which go well beyond those of specific machine process mastery, into management, sales, and engineering, and even company ownership and development.

Occupational Description and Benchmarks for Metalforming

Occupational Description

Metalforming skills are used by skilled tradespersons who have achieved proficiency in the handling and placing tooling and materials into service, in setup and operation of metal stamping equipment, in quality skills related to metal stamping, and in some planning and job control skills. There are many types of stamping presses in the industry. The distinction in the skills of a stamping metalformer is not determined as much by the stamping press, as by the types of tooling and ancillary devices he or she is competent to operate.

A metalformer with specific Level I metalforming skills and a basic knowledge of the operation of the different types of tooling used in metal stamping can meet the proficiency requirements of the Level II stamping skill standard. To achieve Level III stamping skill proficiency the metalformer must master the setup and troubleshooting skills required in the stamping operation.

The following are general areas of competency:

- Care and use of tooling
- Handling, use, and installation of materials and related fluids
- Setup and operation of metalforming equipment
- Inspection and quality assurance skills
- Work planning and job control

Safety is a responsibility that cuts across all competencies for the metalformer. Each competency has its own level of related safety. Skilled metalformers are expected to know, use, and execute correctly all matters related to safety for these competencies. All performance assessments for these metalforming competencies will include the skills listed below as well as execution of all safety practices. Level III metalformers may have modest training and supervision responsibilities for other operators or production workers.

Tooling Skills

- Locate and identify tooling.
- Transport tooling.
- Install tooling.
- Verify function of tooling.

Work Planning and Job Control Skills

- Identify dies.
- Assure that tooling is staged for successor jobs.
- Assure that material is staged for successor operations.
- Assure that material handling containers are staged for successor operations

Handling of Materials and Related Fluids Skills

- Deliver and stage lubricants.
- Deliver and stage coolants.
- Locate, identify, transport, and stage stock.
- Load auxiliary devices.

Setup and Operation of Metalforming Equipment

- Install dies and verify the function of dies.
- Install and verify the function of auxiliary devices.
- Provide lubricants and coolants for tooling and machinery.

Inspection and Quality Assurance Skills

- Follow and document inspection procedures for in-process inspection.
- Follow inspection process plans.
- Perform visual inspection.
- Perform dimensional inspection.
- Collect data according to quality control plans.
- Use optical comparator for inspection tasks.
- Use gage blocks for shop calibration of precision tools.

Other Skills and Competencies

- Operate fork lifts, cranes, and other material handling devices.
- Verify that data are being supplied to the manufacturing control system.
- Adhere to EPA and OSHA guidelines.

Throughout the Metalforming Skill Standard the phrase "process plan" is used. This phrase should be construed to include the step-by-step instructions for setup procedures and quality plans that include step-by-step inspection plans and data collection instructions.

This standard was developed to build on the Metalforming Level I Skill Standards. Competency requirements for Level I Metalforming Skills serve as the base line skills necessary for a metalformer meeting the competencies of the Level II Stamping Skill Standards. The KSAO's from Metalforming Level I appropriate for Stamping Skills Level II and III are incorporated into these documents. Please contact PMA's Training and Education Manager for a copy of the Metalforming Level I Skill Standards.

Figure 2. Framework for Level II Stamping Skills

This figure represents the two principal sets of expectations that comprise Level II Stamping Skills. The left-hand column is a listing of the duties that are expected to constitute Level II jobs. The right-hand column is a listing of the abilities, skills, knowledge, or other characteristics that are needed to perform the duties.

Occupational Duties	Knowledge, Skills, Abilities, and Other Characteristics
1. Quality Control and Inspection 1.1 Part Inspection Using an Optical Comparator	**1. Metalworking Theory** 1.1 Lubricants, Cutting Fluids and Coolants
2. Operation 2.1 Monitor Process, Record Required Production Data Respond to Problems 2.2 Select, Load and Restart Materials 2.3 Adjust Straighteners 2.4 Adjust Feeders 2.5 Adjust Cradles and Reels 2.6 Adjust Conveyors, Magazines and Unloaders 2.7 Operate Machines with Single Hit Die Tooling 2.8 Operate Machines with Compound Die Sets 2.9 Operate Machines with Non-Sensored Progressive Die Sets 2.10 Operate Machines with Sensored Progressive Dies 2.11 Operate Machines with Transfer Dies 2.12 Operate Machines with Single Deep Drawing Operations 2.13 Operate Machines with Double Deep Drawing Operations 2.14 Operate Machines with Reverse Deep Drawing Operations	**2. Die Theory** 2.1 Material Delivery Systems
3. Preventive Maintenance 3.1 Adjust Lubrication System, Fill and Refill the Lubrication Systems	**3. Safety** 3.1 OSHA Regulations 3.2 Lock-Out, Tag-Out Procedures
	4. Sensor Technology 4.1 Recognizes Types of Sensors and Their Application **Appendix A** Knowledge, Skills, and Other Abilities from Level I Machining Skill Standards

Duty Area: 1. Quality Control and Inspection
Duty Title: 1.1 Part Inspection Using an Optical Comparator

Duty:
Given a finished part, set up and perform the inspection of profiles in shadow and/or reflection.

Performance Standard:
Given a finished part, process plan, blueprint, as well as access to appropriate drafting supplies, and optical comparator, inspect a part's specified profiles. Produce data necessary to describe the compliance of the profiles.

Accuracy Level: NA

Assessment Equipment and Material:
Workstation: An optical comparator and necessary drafting supplies and equipment.
Material: A finished part matching the blueprint, vellum or tracing paper.
Tooling: Tooling appropriate to the presentation of a part on an optical comparator.
Measuring Instruments: Precision tools and gages needed to operate the comparator.
Reference: Machinery's Handbook.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Quality Contorl and Inspection Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading		5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
X	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules		7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
	4.1 Group Participation and Teamwork		
	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.1 Monitor Process, Record Required Production Data, Respond to Problems

Duty:
While in production, monitor the process, record data required by the control and quality plan, and respond to problems as they arise whether by physical presentation or by data analysis.

Performance Standard:
Given a setup verified for safety, correct operation of tooling and waste management, and an appropriate process monitoring plan, perform the monitoring plan and respond to its requirements while performing the production run.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Sheet stock form work in process.
Tooling: Tongs, magnets, suction cups, clamps, and dies.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Monitoring Process, Recording Required Production Data and Responding to Problems Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.2 Select, Load, and Restart Materials

Duty:
Whether prior to production or in production, when necessary, select, load, and restart materials required by the process plan.

Performance Standard:
Given a setup in production, verified for safety, and with exhausted material supply, select, load, and place back into production a new batch of material.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
References: NA.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Selecting, Loading and Restarting Materials Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.3 Adjust Straighteners

Duty:
Adjust straighteners to produce effective stock presentation to the tooling.

Performance Standard:
Given an operation to be performed, adjust straighteners to present the stock to enter, flow through, and exit the tooling in the most efficient manner.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Adjusting Straighteners Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	X	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	X	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.4 Adjust Feeders

Duty:
Adjust feeders to present stock to each tooling station at an appropriate rate.

Performance Standard:
Given a setup to be performed, adjust feeders to advance the stock at the correct pitch to match the requirements of the tooling.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Adjusting Feeders Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.5 Adjust Cradles and Reels

Duty:
Adjust cradles and payout reels to provide material to other auxiliary devices or tooling.

Performance Standard:
Given a setup to perform, adjust a cradle or payout reel to pay out material at a rate that enables smooth and continuous production.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Adjusting Cradles and Reels Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.6 Adjust Conveyors, Magazines, Take-Up Reels, and Unloaders

Duty:
Adjust conveyors, magazines, take-up reels, and unloaders.

Performance Standard:
Given a setup to perform, adjust conveyors, take-up reels, magazines, and unloaders to handle the output of tooling so that the parts produced are kept from unwarranted post-production damage and scrap material is segregated into appropriate storage containers.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Adjusting Conveyors, Magazines, Take-Up Reels, and Unloaders Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.7 Operate Machines with Single Hit Die Tooling

Duty:
Operate machines with single-hit tooling installed for production.

Performance Standard:
Given a setup in production with single-hit tooling and verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of the Machines with Single-Hit Die Tooling Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.8 Operate Machines with Compound Die Sets

Duty:
Operate machines with compound die sets installed for production.

Performance Standard:
Given a setup in production using compound dies and verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan**.**

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Compound Die Sets Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.9 Operate Machines with Non-Sensored Progressive Die Sets

Duty:
Operate machines with non-sensored progressive die sets installed for production.

Performance Standard:
Given a setup in production using non-sensored progressive dies and verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Non-Sensored Progressive Die Sets Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.10 Operate Machines with Sensored Progressive Dies

Duty:
Operate machines with sensored progressive die sets installed for production.

Performance Standard:
Given a setup in production using sensored progressive dies and verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Sensored Progressive Dies Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.11 Operate Machines with Transfer Dies

Duty:
Operate machines with transfer dies installed for production.

Performance Standard:
Given a setup in production that is using transfer dies and is verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Transfer Dies Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving Solv		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.12 Operate Machines with Single Deep-Drawing Operations

Duty:
Operate machines with tooling performing single deep-drawing operations.

Performance Standard:
Given a setup in production that is performing single deep-drawing operations and is verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Single Deep-Drawing Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
X	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.13 Operate Machines with Double Deep-Drawing Operations

Duty:
Operate machines with tooling performing double deep-drawing operations.

Performance Standard:
Given a setup in production that is performing double deep-drawing operations and is verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Double Deep-Drawing Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Operation
Duty Title: 2.14 Operate Machines with Reverse Deep-Drawing Operations

Duty:
Operate machines with tooling performing reverse deep-drawing operations.

Performance Standard:
Given a setup in production that is performing reverse deep-drawing operations and is verified for safety, continue to produce parts in the manner prescribed by the process plan.

Accuracy Level: Job process plan.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Operation of Machines with Reverse Deep-Drawing Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic		6.3 Surface Plate Instruments
	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry	*X*	7.2 Tooling
X	2.5 Applied Statistics	*X*	7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules	*X*	7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 3. Preventive Maintenance
Duty Title: 3.1 Adjust Lubrication System, Coolants, Fill and Refill the Lube System

Duty:
Fill and refill lubrication and coolant reservoirs as necessary with appropriate lubricants and fluids. Perform associated housekeeping tasks.

Performance Standard:
Given a machine and tooling with lube systems, fill the lubrication reservoirs as required by the machine and tooling specifications. Adjust flow rates for the delivery of lubes and coolants. Perform associated housekeeping and spill-containment responsibilities.

Accuracy Level: NA.

Assessment Equipment and Material:
Workstation: An appropriate press and tooling.
Material: Oil and lubricants and coolants.
Tooling: N/A.
Measuring Instruments: Sight gages and dipsticks.
Reference: OEM manuals; process plan.

Metalforming Skills: Stamping Level II

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Preventive Maintenance Duty.

	1. Written and Oral Communication		**5. Engineering Drawings and Sketches**
X	1.1 Reading	*X*	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics	*X*	6.2 Precision Measurements
X	2.1 Arithmetic	*X*	6.3 Surface Plate Instruments
X	2.2 Applied Geometry		**7. Metalworking Theory**
	2.3 Applied Algebra		7.1 Cutting Theory
	2.4 Applied Trigonometry		7.2 Tooling
	2.5 Applied Statistics		7.3 Material Properties
	3. Decision Making and Problem Solving		7.4 Machine Tools
X	3.1 Applying Decision Rules		7.5 Cutting Fluids and Coolants
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
	4.1 Group Participation and Teamwork		
	4.2 Personal Qualities		

KSAO Area: 1. Metalworking Theory
KSAO 1.1 Lubricants, Cutting Fluids, and Coolants

KSAO Definition:
Recognizes, selects, and understands the application of appropriate lubricants, cutting fluids and coolants, whether synthetic or organic. Recognizes associated housekeeping, environmental, and safety responsibilities.

Performance Requirement:
Given a set of operations, identify the appropriate lubricants, coolants and its deleivery system for the operations.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Cutting Fluids and Coolants KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Select appropriate coolants and delivery systems for a given set of operations.
2. Job execution	Operate metal stamping equipment in production.	Operate metal stamping to perform specific production operations using specified coolants and coolant delivery systems.

KSAO Area: 2. Die Theory
KSAO: 2.1 Material Delivery Systems

KSAO Definition:
Identify the common components of a material delivery system. Explain the role of each element of the delivery system. Explain the critical considerations that govern the successful functioning of a material handling system.

Performance Requirement:
Given a number of specific examples of material handling systems, identify the components of the systems, explain the role of the components in the system, and identify the critical considerations for successful functioning of each of the systems.

Duty Standard Cross Reference Table:
This table identifies some of the activities that are part of the material delivery system KSAO

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Select appropriate material delivery sytems for a given set of operations.
2. Job execution	Explain the role of various components in material delivery systems.	Identify the components and the critical considerations in the selection of each.
3. Quality and inspection	Inspection control	Describe how to verify that the correct delivery system has been selected.

KSAO Area: 3. Safety
KSAO: 3.1 OSHA Regulations

KSAO Definition:
Know the provisions of OSHA regulations in the operation of metal stamping equipment.

Performance Requirement:
Carry out assigned responsibilities while adhering to safe parctices in accordance with OSHA requirements and guidelines. Document safety activities as required.

Duty Standard Cross Reference Table:
This table identifies some of the activities that apply to safe practices and OSHA regulations

Duty	Task	Activity
1. Job planning	Prepare a process plan including all safety requirements.	Understand and explain the safety hazards associated with metal stamping.
2. Job execution	Verify selection of safety devices.	Confirm that the correct safety devices have been selected in compliance with OSHA requirements.

KSAO Area: 3. Safety
KSAO: 3.2 Lock-Out, Tag-Out Procedures

KSAO Definition:
Know lock-out and tag-out procedures

Performance Requirement:
Given a scenario in which lock-out and tag-out procedures are appropriate, describe in detail the application of the procedures.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Safety KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan including all safety requirements.	Understand and explain the safety hazards associated with metal stamping.
2. Job execution	Verify selection of safety devices.	Confirm that the correct safety devices have been selected in compliance with OSHA requirements.

KSAO Area: 4. Sensor Technology
KSAO: 4.1 Recognize Types of Sensors and Their Applications

KSAO Definition:
Recognize limit, light, proximity, pressure, motion, fiber optic, laser and vibration signature sensors and understand their application.

Performance Requirement:
Given scenarios using various sensors identify the type of sensor and explain their application in each specific case.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Sensor Recognition KSAO.

Duty	Task	Activity
1. Job planning	Prepare a process plan.	Identify sensors to be used.
2. Job execution	Demonstrate a knowledge of sensors.	Select sensors appropriate to a specified piece of equipment and a specified production run.

Appendices

A. Knowledge, Skills, Abilities, and Other Characteristics

B. Metalworking Industry Skill Standards Board and Project Staff

C. Metalworking Industry Skill Standards Project Steering Committee Members

D. The Metalforming Stamping Technical Work Group

E. Metalforming Stamping Skill Standards Regional Validation Participants

F. Related Metalworking Skill Standards

Appendix A

Knowledge, Skills, Abilities, and Other Characteristics

An individual planning to meet these standards will be required to be able to perform the basic knowledge, skills, abilities, and other characteristics (KSAOs) called for in the Level I Machining Skill Standards. These include:

Written and Oral Communications
Mathematics
Decision Making and Problem Solving
Social Skills and Personal Qualities
Engineering Drawings and Sketches
Measurement

Note: The foundation skills for Metalforming Level II are found in Machining Level I skill standards primarily in the knowledge and abilities skills. The basic skills are given in this appendix; however it is recommended that the candidate for this skill level review the Machining Level I skills document as part of preparation for credentialing.

KSAO Area: 1. Written and Oral Communication
KSAO: 1.1 Reading

KSAO Definition:
Locates, understands, and interprets written technical and non-technical information in documents commonly found in the metalworking industry. These documents contain short and simple sentences, paragraphs and passages, phrases, quantitative information, specialized vocabulary, graphs, charts, schedules, simple instructions, and multi-step directions. All documents are written in standard English.

Performance Requirement:
Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, locate and read the necessary information and use this information to plan, execute, and evaluate the duty and answer questions about the content or meaning of the written information.

Duty Standard Cross Reference Table

This table identifies some of the activities that require the Reading KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Read blueprints. Read tool crib inventory. Read the Handbook.
2. Job execution	Benchwork Layout Operate machine tools	Read blueprints. Read process plans. Read the Handbook.
3. Quality and inspection	Inspection Control	Read blueprints. Read inspection plan. Read sampling plan. Read charting instructions.
4. Process improvement	Process adjustment Participation in improvement	Read blueprints. Read process plans. Read the Handbook. Read team documents.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Read checklists. Read manuals.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Read safety instructions.

KSAO Area: 1. Written and Oral Communication
KSAO: 1.2 Writing

KSAO Definition:
Communicates technical and non-technical information, messages, and ideas in writing using standard English commonly found in the metalworking industry. This writing includes the completion of forms, information sheets, reports, group meeting materials, and short memos.

Performance Requirement:
Given a specific duty to perform and the necessary instructions, forms, and materials to complete the writing requirements for that duty, complete the writing requirement.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Writing KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Write instructions on the process plan.
2. Job execution	Benchwork Layout Operate machine tool**s**	Write a record of job activities.
3. Quality and inspection	Inspection Control	Write a record of inspection activities.
4. Process improvement	Process adjustment Participation in improvement	Write a record of adjustment and improvement activities**.**
5. Maintenance	Housekeeping Machine tool PM Tooling maintenanc**e**	Write a record of maintenance activities. Fill out history forms.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Write a record of the activities involving the handling and storage of standard and hazardous materials.

KSAO Area: 1. Written and Oral Communication
KSAO: 1.3 Speaking

KSAO Definition:
Communicates technical and non-technical detailed information, messages, multi-step directions and ideas through oral communication using standard English and related cues and communication aids in conversations, discussions,1 and group meetings. Understands and responds to listener feedback and asks questions when needed in two-way and group conversations.

Performance Requirement:
Given a specific duty to perform and the necessary instructions, written documents, and communication aids and materials to complete the speaking requirements for that duty, complete the speaking requirement.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Speaking KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Verbally explain the process plan.
2. Job execution	Benchwork Layout Operate machine tools	Explain job execution activities.
3. Quality and inspection	Inspection Control	Explain inspection procedures. Explain control charts and their role in process control.
4. Process improvement	Process adjustment Participation in improvement	Propose process remedies. Explain the selected corrective actions. Explain fishbone charts. Explain root cause reasoning.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Explain the condition of machine tools and the maintenance actions taken.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Explain actions bearing on safe practice.

KSAO Area: 1. Written and Oral Communication
KSAO: 1.4 Listening

KSAO Definition:
Listens for, receives, interprets, and recalls specific details, ideas, and multi-step instructions in verbal presentations, conversations, discussions, and group meetings conducted in standard English and supported by written materials and other communication cues and aids. Uses active listening skills in comprehending simple technical and non-technical verbal information.

Performance Requirement:
Given a specific duty to perform and the necessary written information contained on relevant documents and information sheets, listen for, comprehend, and incorporate oral information in the performance of the duty and answer questions about the content or meaning of the oral information.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Listening KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan	Listen to verbal instructions.
2. Job execution	Benchwork Layout Operate machine tools	Listen to verbal instructions.
3. Quality and inspection	Inspection Control	Listen to verbal instructions.
4. Process improvement	Process adjustment Participation in improvement	Listen to verbal instructions.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Listen to verbal instructions.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Listen to verbal instructions.

KSAO Area: 2. Mathematics
KSAO: 2.1 Arithmetic

KSAO Definition:
Performs addition, subtraction, multiplication, and division of whole numbers without a calculator, and performs calculation of fractions and decimals, as well as conversion to metric measurement with or without a calculator.

Performance Requirement:
Given a specific duty to perform requiring arithmetic operations, conduct arithmetic operations.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Arithmetic KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Calculate speeds and feeds. Calculate operation times.
2. Job execution	Benchwork Layout Operate machine tools	Calculate necessary dimensions from the blueprint.
3. Quality and inspection	Inspection Control	Calculate necessary dimensions from the blueprint. Calculate statistics required by control charts.
4. Process improvement	Process adjustment Participation in improvement	Calculate the impact of a change of speed or feed.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Calculate the length of time spent in a PM activity.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Calculate the volume of material stored.

KSAO Area: 2. Mathematics
KSAO: 2.5 Applications of Statistics

KSAO Definition:
Uses standard formulas and arithmetic operations to calculate means, medians, modes, and ranges with or without a calculator.

Performance Requirement:
Given a specific duty to perform requiring the use of formulas and arithmetic operations, conduct the required statistical calculations using standard formulas.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Applications of Statistics KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Use SPC as part of a process plan.
3. Quality and inspection	Inspection Control	Use SPC to control quality.
4. Process improvement	Process adjustment Participation in improvement	Use SPC to analyze process performance.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Use SPC to evaluate safety performance.

KSAO Area: 3. Decision Making and Problem Solving
KSAO: 3.1 Applying Decision Rules

KSAO Definition:
Can follow a set of instructions laid out in a sequence. Can interpret and follow "if....then...." instructions.

Performance Requirement:
Given a specific duty to perform requiring a checklist of sequential instructions, carry out the duty making appropriate entries on the checklist.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Applying Decision Rules KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Follow the process plan, deviating according to decision rules where necessary.
3. Quality and inspection	Inspection Control	Follow the quality plan, deviating according to decision rules where necessary.
4. Process improvement	Process adjustment Participation in improvement	Apply checklists and decision rules to process improvement.
5. Maintenance	Housekeeping Machine tool PM Tooling maintenance	Apply company procedures to housekeeping, PM, and TM.
6. Safety and environment	Operations and handling HazMat handling & storage Material storage	Apply OSHA and EPA decision rules to the storage and handling of materials.

KSAO Area: 3. Decision Making and Problem Solving
KSAO: 3.2 Basic Problem Solving

KSAO Definition:
Can establish new responses to unexpected problems of a simple nature. Can formulate the new responses into a sequence of instructions or a set of "if ... then ..." rules.

Performance Requirement:
Given a specific duty to perform and being furnished with a checklist of sequential instructions, carry out the duty according to the checklist responding appropriately to problems. Formulate those responses into "if ... then ..." rules.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Basic Problem Solving KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Sequence operations, providing alternatives according to availability of tools and equipment.
2. Job execution	Benchwork Layout Operate machine tools	Follow a process plan, improvising new methods where unavailability of tooling makes the plan obsolete.

KSAO Area: 5. Engineering Drawings and Sketches
KSAO: 5.1 Standard Orthographic Blueprints

KSAO Definition:
Interprets orthographic blueprints.

Performance Requirement:
Given a standard blueprint and a finished part from that print, prepare a checklist of dimensions necessary to determine the part's compliance.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Standard Orthographic Blueprint KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Gather geometric and dimensional data from a blueprint to sequence operations.
2. Job execution	Benchwork Layout Operate machine tools	Gather geometric and dimensional data from a blueprint to perform a layout.
3. Quality and inspection	Inspection Control	Gather geometric and dimensional data from a blueprint to carrry out the inspection of a finished part.

KSAO Area: 6. Measurement
KSAO: 6.1 Basic Measuring Instruments

KSAO Definition:
Recognizes and applies basic measuring instruments such as rules, protractors, and basic transfer tools such as simple inside and outside calipers.

Performance Requirement:
Given a blueprint and a finished part from that print, as well as a selection of appropriate basic measuring instruments, determine a part's compliance on selected dimensions.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Basic Measurement Instruments KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Set the length of layout tools using basic instruments.
3. Quality and inspection	Inspection Control	Inspect dimensions which call for the use of basic measuring tools on a finished part.

KSAO Area: 6. Measurement
KSAO: 6.2 Precision Measuring Instruments

KSAO Definition:
Recognizes and applies precision measuring instruments such as micrometers, vernier, dial, and electronic calipers, dial indicators, precision transfer tools such as telescoping gages and adjustable parallels.

Performance Requirement:
Given a blueprint and a finished part from that print, as well as a selection of appropriate precision tools, determine a part's compliance on selected dimensions.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Precision Measuring Instruments KSAO.

Duty Area	Task	Activity
2. Job execution	Benchwork Layout Operate machine tools	Determine the concentricity of a turned part to a lathe's spindle using an indicator.
3. Quality and inspection	Inspection Control	Inspect the dimensions of a finished part which call for the use of precision measuring tools.

Appendix B

Metalworking Industry Skill Standards Board and Project Staff

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Metalforming Skills: Stamping Level II

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Somerset, NJ

David Smith
Smith and Associates
Monroe, MI

Charles A. Vanella
Unarco Material Handling
Sprinfield, TN

Tom Walker
Walker Corp.
Ontario, CA

John Wells
Lacey Manufacturing Co.
Bridgeport, CT

Marvin Wortell
Triton Industries
Chicago, IL

James Zawacki
Grand Rapids Spring & Wire Products, Inc.
Grand Rapids, MI

Appendix F

Related Metalworking Skill Standards

Machining Skills Level I
Machining Skills Level II
Machining Skills Level III
Metalforming Skills - Stamping Level II
Metalforming Skills - Stamping Level III
Metalforming Skills - Spinning Level II
Metalforming Skills - Roll Forming Level II
Machine Building Skills Level II (Available Spring 1996)
Machine Building Skills Level III (Available Spring 1996)
Screw Machining Skills Level II (Available Spring 1996)
Screw Machining Skills Level III (Available Spring 1996)

Other skill standards are under development.