Duties and Standards

for

METALFORMING SKILLS

Stamping Level III

Approved by

The National Institute for Metalworking Skills, Inc.

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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.

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Overview

Background

In late fall 1992, the U.S. Departments of Education and Labor launched an initiative to fund industry organizations and consortia to develop national occupational skill standards for their industries. Skill standards refer to the major duties, knowledge, and skills that workers must be proficient in to meet performance requirements and expectations in the modern workplace. The national basis of these standards refers to the process followed in their development, namely that they be reviewed and reflect employer and employee opinions in the industry as that industry is distributed nationwide. The skill standards, once established, are intended to guide workforce development programs in the public and private sectors in building a world-class workforce in the United States.

The National Tooling and Machining Association (NTMA) was selected to work with other leading organizations in the metalworking industry to establish national skill standards for metalworking occupations. This effort is developing standards with input from workers, employers, trainers, and educators nationwide. The standards are being benchmarked to those in 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 the metalworking industry. They also are intended for application in upgrading programs, retraining programs, and apprenticeships for workers already employed by metalworking companies.

NTMA has been joined by the Association for Manufacturing Technology, the International Association of Machinists and Aerospace Workers, Michigan Tooling Association, the National Screw Machine Products Association, the Precision Metalforming Association, and the Tooling and Manufacturing Association in this skill standards development effort.[1] These associations cooperated to form a Metalworking Industry Skill Standards Board to guide the establishment of national standards for the industry. Three major responsibilities of the Board include:

- developing recognized occupations organized into career paths within the industry;
- writing and verifying skill standards for each recognized career path; and

[1]The Council of Great Lakes Governors also is participating. The Council and six of its member states pledged to pilot the metalworking skill standards in publicly administered training programs. Representatives from the Council and involved states attend meetings of the Metalworking Industry Skill Standards Board and serve on an overall project steering committee.

- promoting the skill standards for use in the training, assessment, and credentialing of workers.

The Metalworking Industry Skill Standards Board held its first meeting in Indianapolis in May 1993, and recognized that career paths can develop from four major occupational groups in the metalworking industry. (see Figure 1) These are machining, tool and die, metalforming and machine building and maintenance. Within each occupational cluster, multiple job titles can exist and such titles as may be invoked were seen as the prerogative of individual metalworking companies. The Board focused on defining skills and agreed that each grouping would determine the levels needed to describe the increasing competency levels within their occupational cluster.

After a series of Technical Work Group meetings and Regional validation sessions it was determined that three levels were needed to demonstrate increasing competencies and skills with more complex equipment in machining. These standards have now been completed and published.

The Metalforming Industry has concluded that once the basic metalworking skills described in the Machining Skills-Level I standards are mastered, that the additional skill requirements called for in roll forming, spinning and in stamping can be covered in one additional and separate standard for each process. In making this determination the writers of the standard emphasized that there are different levels of performance in the skills called for, but that the difference comes from experience and expanded expertise rather than in a change in the duties called for in this standard.

Occupational Description and Benchmarks for Metalforming

Occupational Description

Metalforming skills are used by skilled tradespersons who have achieved competency in the handling and placing tooling and materials into service, in setup and operation of metalstamping equipment, in quality skills related to metal stamping, and in some planning and job control skills. There are many types of stamping presses in 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 requirements of a Level II Metalforming Stamping Operator. To achieve Level III stamping skill competency 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 the metalforming competencies will include the use and execution of all safety practices. Skilled 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 coordinate measuring machine.
- 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 III 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 III Stamping Skills

This figure represents the two principal sets of expectations that comprise Level III Stamping Skills. The left-hand column is a listing of the duties that are expected to constitute Level III 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 a Coordinate Measuring Machine	**1. Metalworking Theory** 1.1Clamping and Mechanical Workholding Systems
2. Setup Operation 2.1 Set Up and Test Safety Systems 2.2 Set Up and Adjust Lubrication and Coolant Systems, Fill and Refill the Lubricant and Coolant 2.3 Set Up Machines with Single-Hit Die Tooling 2.4 Set Up Machines with Compound Dies 2.5 Set Up Machines with Non-Sensored Progressive Dies 2.6 Set Up Machines with Sensored Progressive Dies 2.7 Set Up Machines with Transfer Dies 2.8 Set Up Machines with Single Deep-Drawing Operations 2.9 Set Up Machines with Double Deep-Drawing Operations 2.10 Set Up Machines with Reverse Deep-Drawing Operations 2.11 Verify Product Quality 2.12 Setup Handoff: Communicate Operating Plan and Safety Requirements to an Operator 2.13 Troubleshoot Running Processes 2.14 Verify Safety Systems	**2. Die Theory** 2.1 Identify Types of Dies 2.2 Application and Function of Pilots 2.3 Transfer Technology
	3. Material Delivery 3.1 Material Delivery Systems

Duty Area: 1. Quality Control and Inspection
Duty Title: 1.1 Part Inspection Using a Coordinate Measuring Machine

Duty:
Given a finished part, set up and perform the inspection of parts using a coordinate measuring machine. Collect appropriate data and record them as required.

Performance Standard:
Given a finished part, process plan, and blueprint, inspect a part's key quality characteristics. Produce data necessary to describe the compliance of the part's characteristics.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: A Manual Coordinate Measuring Machine
Material: A finished part matching the blueprint.
Tooling: Tooling appropriate to the presentation of a part on the Coordinate Measuring Machine
Measuring Instruments: N/A.
Reference: Machinery's Handbook.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Quality Control Coordinate Measuring Machine 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	*X*	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		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. Setup Operations
Duty Title: 2.1 Set Up and Test Safety Systems

Duty:
Set up and test all safety system connected with a production run.

Performance Standard:
Given a process plan and a setup to be implemented, set up and activate all safety systems called for by the process plan. Verify the correct operation and adjustment of the safety systems.

Accuracy Level: N/A.

Assessment Equipment and Material:
Workstation: A press appropriate to the dies.
Material: Personal protective equipment, protective guards, protective devices.
Tooling: Wrenches, screwdrivers, and assorted hand tools.
Measuring Instruments: Rules.
Reference: OSHA requirements and a process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup Safety Testing 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	*X*	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
	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		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. Setup Operations
Duty Title: 2.2 Set Up and Adjust Lubrication and Coolant Systems, Fill and Refill the Lubricant and Coolant Systems

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

Performance Standard:
Given a machine and setup with lube and coolant systems, set up and test the lube and coolant systems. Fill the lubrication and coolant reservoirs as required by the job specifications and machine and tooling requirements. Set flow rates for the delivery of lubes and coolants. Perform associated housekeeping and spill-containment responsibilities.

Accuracy Level: N/A.

Assessment Equipment and Material:
Workstation: An appropriate press, tooling and auxiliary equipment.
Material: Oil, lubricants, and coolants.
Tooling: Lubricant and coolant storage and delivery devices.
Measuring Instruments: Sight gages and dipsticks.
Reference: OEM manuals and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of the Lubrication Systems 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	*X*	5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	*X*	6.1 Basic Measurements
	2. Mathematics		6.2 Precision Measurements
	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		
	4.1 Group Participation and Teamwork		
	4.2 Personal Qualities		

Duty Area: 2. Setup Operations
Duty Title: 2.3 Set Up Machines with Single-Hit Die Tooling

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

Performance Standard:
Set up production with single-hit tooling and verify for safety; produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup With Single Hit Tooling 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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.4 Set Up Machines with Compound Dies

Duty:
Set up machines with compound die sets for production.

Performance Standard:
Set up production using compound dies and verify for safety; produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Compound 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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.5 Set Up Machines with Non-Sensored Progressive Dies

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

Performance Standard:
Set up production using non-sensored progressive dies and verify for safety, produce parts in the manner prescribed by the process plan.

Accuracy Level: Part Specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Machines with Non-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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.6 Set Up Machines with Sensored Progressive Dies

Duty:
Set up machines with sensored progressive die sets for production.

Performance Standard:
Set up production using sensored progressive dies and verify for safety, produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Machines with Sensored 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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

Duty Area: 2. Setup Operations
Duty Title: 2.7 Set Up Machines with Transfer Dies

Duty:
Set up machines with transfer dies for production.

Performance Standard:
Set up production using transfer dies and verify for safety; produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of 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	*X*	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
X	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. Setup Operations
Duty Title: 2.8 Set Up Machines with Single Deep-Drawing Operations

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

Performance Standard:
Set up production using single deep-drawing tooling and verify for safety; produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Single Deep Draw 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	*X*	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
X	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. Setup Operations
Duty Title: 2.9 Set Up Machines with Double Deep-Drawing Operations

Duty:
Set up machines with tooling performing double deep drawing operations.

Performance Standard:
Setup production using double deep drawing tooling, and verify for safety, produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Machines with Double Deep Draw Operations 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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.10 Set Up Machines with Reverse Deep-Drawing Operations

Duty:
Setup machines with tooling performing reverse deep drawing operations.

Performance Standard:
Setup production using reverse deep drawing tooling, and verify for safety, produce parts in the manner prescribed by the process plan.

Accuracy Level: Part specifications.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup of Machines with Reverse Draw Operations 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	*X*	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**
X	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. Setup Operations
Duty Title: 2.11 Verify Product Quality

Duty:
Verify the conformance of a station's product to the process plan's specification for that product prior to full production.

Performance Standard:
Given a setup verified for safety, correct operation of tooling and waste management, and an appropriate sample of parts produced by the setup, verify the sample's conformance to the job specifications for that station.

Accuracy Level:
Job specifications within statistical quality standards for the parts produced.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Verification of Product Quality 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	*X*	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
	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. Setup Operations
Duty Title: 2.12 Setup Handoff: Communicate Operating Plan and Safety Requirements to an Operator

Duty:
Communicate the requirements of performing a production run and the operation of its associated safety systems.

Performance Standard:
Having performed a setup and verified its suitability for production, communicate the requirements of the operation and its safety systems to an operator. Verify the correct operation of the safety systems for that operator. Make the operator aware of the safety systems, drawings and process plan and quality control requirements of the job.

Accuracy Level: N/A.

Assessment Equipment and Material:
Workstation: An appropriate press.
Material: Stock selected for production.
Tooling: Tongs, magnets, suction cups, clamps, and assorted handtools.
Measuring Instruments: Rules, micrometers, verniers, squares, specialty gages, and attribute gages.
Reference: Machinery's Handbook and process plan.

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Setup Handoff 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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.13 Troubleshoot Running Processes

Duty:
While in production, perform causal analysis on problems as they arise whether by physical presentation or by data analysis.

Performance Standard:
Given a producing setup verified for safety, an appropriate process monitoring plan, and unspecified problems existing in the performance of the run, perform causal analysis on the problems, identifying the problems and their causes.

Accuracy Level: N/A.

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

Metalforming Skills: Stamping - Level III

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in the performance of the Troubleshooting 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	*X*	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
X	2.2 Applied Geometry		**7. Metalworking Theory**
X	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. Setup Operations
Duty Title: 2.14 Verify Safety Systems

Duty:
Verify the proper operation of all safety systems prior to full production.

Performance Standard:
Given a ready to run setup, job specifications, and appropriate handoff instructions from a setup person, verify the correct function and adjustment of all related safety systems.

Accuracy Level: N/A.

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

Metalforming Skills: Stamping - Level III

KSAO:

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

	1. Written and Oral Communication		
X	1.1 Reading		
X	1.2 Writing		
X	1.3 Speaking		
X	1.4 Listening		
	3. Decision Making and Problem Solving		
X	3.1 Applying Decision Rules		
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
X	4.1 Group Participation and Teamwork		
X	4.2 Personal Qualities		

KSAO Area: 1. Metalworking Theory
KSAO: 1.1 Clamping and Mechanical Workholding Systems

KSAO Definition:
Recognizes, selects, and understands the use of appropriate clamping or mechanical work-holding tooling.

Performance Requirement:
Given dies and associated auxiliary devices to be placed into production, identify appropriate clamping or work-holding tooling and methods to secure the dies and auxiliary devices in place for production.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require a knowledge of workholding systems.

Duty	Task	Activity
1. Job planning	Select workholding device	Read blueprint Read process plan
2. Job execution	Install workhold device	Install workhold device and verify safe operation

KSAO Area: 2. Die Theory
KSAO: 2.1 Identify Types of Dies

KSAO Definition:
Recognize die types and die functions.

Performance Requirement:
Given a variety of dies, identify the types of the dies and their functions.

Duty Standard Cross Reference Table:
This table identifies some of the activities required in the die identification KSAO.

Duty	Activity
Identify single hit tooling	Explain when a single hit die is used
Identify compound tooling	Explain when compound tooling is used
Identify non-sensored progressive dies	Explain when non-sensored dies are used
Identify sensored progressive dies	Explain when sensored dies are used
Identify transfer dies	Explain when transfer dies are used
Identify single deep draw dies	Explain when single deep draw dies are used
Identify double deep draw dies	Explain when double deep draw dies are used
Identify reverse deep draw dies	Explain when reverse deep draw dies are used.

KSAO Area: 2. Die Theory
KSAO: 2.2 Application and Function of Pilots

KSAO Definition:
Know the application and function of pilots.

Performance Requirement:
Given a die which is using pilots, identify the pilots and explain their role in the performance of the die.

KSAO Area: 2. Die Theory
KSAO: 2.3 Transfer Technology

KSAO Definition:
Know the theory, application, and function of transfer systems.

Performance Requirement:
Given a transfer die mounted for production, identify the elements of the transfer mechanism, explain the function of the transfer mechanism, its adjustments, and theory of operation.

KSAO Area: 3. Material Delivery
KSAO: 3.1 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.

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 Drawing 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, 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 carry 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

National Institute for Metalworking Skills Board and Project Staff

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Metalforming Skills: Stamping Level III

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Appendix F

Related Metalworking Skill Standards

Machining Skills Level I
Machining Skills Level II
Machining Skills Level III
Metalforming Skills Level I
Metalforming Skills – Metal Spinning Level II
Metalforming Skills – Roll Forming Level II
Metalforming Skills – Slide Forming Level II
Metalforming Skills - Slide Forming Level III
Metalforming Skills – CNC/NC Punch Press Level II
Metalforming Skills – Laser Cutting Level II
Metalforming Skills - Press Brake Level II
Metalforming Skills – Press Brake Level III
Metalforming Skills - Metal Stamping Level II
Metalforming Skills – Metal Stamping Level III
Machine Building Skills Level II
Machine Building Skills Level III
Screw Machining Skills Level II
Screw Machining Skills Level III