Duties and Standards

for

DIEMAKING SKILLS

LEVEL II

The principal author of this skill standards manual is Jerry Johnson, vice-president of Progressive Die and Automation, Grand Rapids, MI, in cooperation with Robert W. Sherman, project director of the National Institute for Metalworking Skills, Inc. (NIMS). The financial support for the development of these standards came from a grant by the National Tooling and Machining Association (NTMA). A special note of thanks goes to James Wallbeoff for his tireless efforts in reviewing and editing the material.

National Institute for Metalworking Skills, Inc. (NIMS)
3251 Old Lee Highway, Suite 205
Fairfax, VA 22030
Phone (703) 352-4971 Fax (703) 352-4991
e-mail -nims@nims-skills.org

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Overview—Diemaking Skills—Level II

The Level II diemaker builds and assembles dies used in the metalforming industry. The skills required to be a diemaker include most of the machining skills listed in *Duties and Standards for Machining Skills ¾ Level II*. While as an assembler, the worker may not directly use all of these skills, it is important that he or she knows and masters them. Therefore, diemaking begins as a Level II partnership with the Level II machining skills standards. The foundation skills required are the manual machining skills called for in *Duties and Standards for Machining Skills ¾ Level I* and *Duties and Standards for Metalforming Skills ¾ Level I.*

The standards, as written, address the metalworking and assembly skills required for dies that call for trim line development. It is understood that dies not requiring development can be readily mastered at this skill level as well. A worker in this profession at Level II must be able to identify and understand the function of electrical, hydraulic, and pneumatic components.

Occupational Description and Benchmarks

Occupational Description

Skills are used by tradespersons who have achieved proficiency in the assembly and manufacture of dies used in the metalforming industry. Quality skills and strong planning and job control skills are critical in this occupation. The general areas of competency include the following:

- Ability to read engineering drawings and visualize the finished product
- Ability to identify, measure, and verify precision parts and components
- High level of proficiency with various machine tools and hand tools
- Inspection and quality assurance skills
- Broad understanding of the operation of mechanical devices
- Knowledge of metallurgy and working properties of metals

Safety and Environment

Safety and environmental concerns are responsibilities that cut across all competencies. Skilled workers are expected to know and execute correctly all matters pertaining to safety and environment for these competencies.

Job Planning Skills

The first step in providing customer satisfaction and economic efficiencies, while utilizing the capabilities available, is the development of an organized approach to the construction of the die. The general areas of competency in job planning include the following:

- Review the design and determine the feasibility of the manufacturing plan.
- Develop the process and manufacturing plan to meet the due date.
- Be aware of cost and waste.
- Develop a plan for in-process inspection and control.

Inspection and Quality Control

- Follow and document in-process inspection.
- Perform trial assemblies to confirm conformance of the components.
- Use precision measuring devices to inspect components.
- Maintain a record of all changes made.

Other Skills and Competencies

- Possess a basic knowledge of metalforming processes and machinery.
- Possess a basic knowledge of metals and their characteristics.

A diemaker with Level II skills may have modest training and supervision responsibilities.

Framework for Diemaking Skills—Level II

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

Occupational Duties	Knowledge, Skills, Abilities, and Other Characteristics
1. Job Planning 1.1 Review Design, Part Print, and Customer Quality Standards 1.2 Determine Required Process Plan to Complete Die/Tool in Allotted Time	**1. Written and Oral Communications** 1.1 Reading 1.2 Writing 1.3 Speaking 1.4 Listening
2. General Machining and Bench Work 2.1 Lay Out Details for Manual Machining Operations 2.2 Machine Details to Die Design Prints Using Standard Tool Room Equipment 2.3 Prepare Details for CNC Milling Operation 1.1 Prepare Trim Punches and Trim Steels for Wire Burn, CNC Milling, or CNC Jig Grinding Operations 2.5 Use Hand Tools on Contoured Steels from CNC Milling Operations 2.6 Grind/Mill or Wire EDM All Other Details to Finished Size After Heat Treat	**2. Mathematics** 2.1 Arithmetic 2.2 Applications of Geometry 2.3 Applications of Algebra 2.4 Applications of Trigonometry
3. Die Assembly 3.1 Mount Form Steels, Form Pads, Nitrogen Units, and Pierce Station to Die Set 3.2 Dry Run Die to Stop Blocks 3.3 Assemble Die for Development Process	**3. Decision Making and Problem Solving** 3.1 Applications of Basic Problem Solving
4. First Tryout 4.1 Set Up Die in Tryout Press 4.2 Spot Form Steels 4.3 Develop Draws and Forms 4.4 Develop Trim Lines 4.5 Validate Part	**4. Social Skills and Personal Qualities** 4.1 Social Skills and Basic Teamwork
5. Final Assembly 5.1 Make Required Adjustments As Determined from First Tryout 5.2 Mount All Remaining Die Details to Die Set 5.3 Dry Run Die to Stop Blocks 5.4 Assemble Die for Final Tryout	**5. Mechanical Skills** 5.1 Applications of Basic Mechanical Problem Solving
6. Final Tryout 6.1 Set Up All Dies in Tryout Presses 6.2 Perform Corrective Actions Required to Assure Stamped Part Conformance 6.3 Assure Production Readiness of Die or Tool 6.4 Participate in Final Runoff	**6. Engineering Drawings and Sketches** 6.1 Standard Orthographic Prints 6.2 GD&T Orthographic Prints 6.3 Basic CAD Skills

Occupational Duties	Knowledge, Skills, Abilities, and Other Characteristics
	7. Measurement 7.1 Basic Measuring Instruments 7.2 Precision Measuring Instruments 7.3 Surface Plate Instruments 7.4 Basic CMM Operation (Manual) 7.5 Metric Measurement and Conversion
	8. Metalworking Theory 8.1 Cutting Tool Technology and Theory 8.2 Basic CNC Operation 8.3 Materials 8.4 Basics of EDM, Wire, and Sinker Categories
	9. Metalforming Theory 9.1 Simple Blanking Pressures 9.2 Simple Forming Pressures 9.3 Nitrogen Manifolds and Their Application 9.4 Draw Radii Use 9.5 Basics of Draw Beads and Their Use
	10. Computers 10.1 Basic Computer Operations
	11. Safety And Environment 11.1 Safe Operation of All Tool and Die Shop Equipment 11.2 Hazardous Materials Disposal 11.3 OSHA Requirements As Applied to Die Building

Duty Area: 1. Job Planning
Duty Title: 1.1 Review Design, Part Print, and Customer Quality Standards

Duty:
Confirm that die designs meet customer die and quality requirements.

Performance Standard:
Review die designs to make sure that they meet customer die and quality standards. Review die design with engineering personnel to reconfirm that all customer and quality requirements have been met. Develop in-process inspection plan to assure conformance with requirements.

Accuracy Level: N\A

Assessment Equipment and Materials:
Workstation: Workbench
Materials: N\A
Tooling: N\A
Measuring Equipment: N\A
References: Customer die standard, part print, quality standards, engineering personnel, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Review Design, Part Print, and Customer Quality Standards Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading		7.1 Basic Measuring Instruments
X	1.2 Writing		7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
X	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 1. Job Planning
Duty Title: 1.2 Determine Required Process Plan to Complete Die/Tool in Allotted Time

Duty:
Participate in developing process plan to meet customer delivery requirements.

Performance Standard:
Review design with engineering personnel to determine which components will require wire burning, CNC milling, and/or duplicating, and participate in the development of a process plan with a project timeline showing critical milestone dates to assure completion in the allotted time.

Accuracy Level: N\A

Assessment Equipment and Materials:
Workstation: Workbench
Materials N\A
Tooling Calculator
Measuring Equipment: N\A
References: Die designs, customer part print, process coordinator, engineering department, process plan, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Determine Required Process Plan to Complete Die/Tool in Allotted Time Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading		7.1 Basic Measuring Instruments
X	1.2 Writing		7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
X	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry		8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.1 Lay Out Details for Manual Machining Operations

Duty:
Lay out details for machining operations.

Performance Standard:
Refer to die design or detail prints and establish the working plane; lay out such features as screw holes, jack screw holes, dowel holes, and rough peripheral shape. Use proper layout aides and precision measuring instruments.

Accuracy Level:
Rough machining tolerances to +/-.005"

Assessment Equipment and Materials:
Workstation: Layout table or workbench
Materials: As specified on bill of material
Tooling: Scriber, combination square, layout bluing, center punch, and ball peen hammer
Measuring Equipment: Height gage, calipers, gage, blocks, protractor, dividers, center punch, micrometers, scale, and layout table
References: Die design, process plan, detail prints, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Lay Out Details for Manual Machining Operations Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking	X	7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry	X	8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
			11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.2 Machine Details to Die Design Prints Using Standard Tool Room Equipment

Duty:
Perform required machining to die design prints.

Performance Standard:
Perform necessary machining to complete non-contoured die details to print and layout lines using standard tool room equipment and proper feeds and speeds.

Accuracy Level:
Print tolerances to +/- .005"

Assessment Equipment and Materials:
Workstation: Workbench and standard machine tools as required
Materials: As specified on the bill of material
Tooling: Carbide or HSS cutting tools as required
Measuring Equipment: Scales, micrometers, depth micrometers, calipers, and dial indicator
References: Die design, part print, customer die standards, process plan, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Machine Details to Die Design Prints Using Standard Tool Room Equipment Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry	X	8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.3 Prepare Details for CNC Milling Operation

Duty:
Prepare details for a CNC milling operation.

Performance Standard:
Square details as required per process plan and die design. Determine and provide mounting method for setup on CNC mill or duplicator.

Accuracy Level:
Rough machining tolerances to +/-.005"

Assessment Equipment and Materials:
Workstation: Machine shop and bench area
Materials: As specified on bill of material
Tooling: Standard tool room equipment
Measuring Equipment: Scale, micrometer, depth micrometer, calipers, and dial indicator
References: Process plan, die design, detail prints, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Prepare Details for CNC Milling Operation Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra	X	8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints	X	10.1 Basic Computer Operations
X	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.4 Prepare Trim Punches and Trim Steels for Wire Burn, CNC Milling, or Jig Grinding Operations

Duty:
Prepare for needed wire burn, CNC milling, or jig grinding operations

Performance Standard:
Using the bill of material, die design, and process plan, select the proper details for the trim punches and die steels, and prepare as required.

Accuracy Level:
Rough machining tolerances to +/- .005"

Assessment Equipment and Materials:
Workstation: Machine shop and bench area
Materials: As specified on bill of material
Tooling: Standard die shop machine tools
Measuring Equipment: Scale, micrometer, calipers, machinist's square, sine plate, and gage blocks
References: Process plan, die design, detail prints, and *Machinery's Handbook*

KSAO:

This table represents the knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Prepare Trim Punches and Trim Steels for Wire Burn, CNC Milling, or CNC Jig Grinding Operations Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking	X	7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra	X	8.2 Basic CNC Operation
	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving	X	8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.5 Use Hand Tools on Contoured Steels from CNC Milling Operations

Duty:
Use hand tools to remove cutter marks.

Performance Standard:
Remove cutter marks as required by using hand tools of varying types and grits to achieve the required surface finish prior to heat treat.

Accuracy Level:
Per print, dimensional accuracy and surface finish as required

Assessment Equipment and Materials:
Workstation: Workbench
Materials: As specified on bill of material
Tooling: Various hand tools for honing, polishing, and finishing as required
Measuring Equipment: Micrometer, calipers, scale, optical flats, depth micrometer, dial indicator, and sine plate
References: Detail prints, die design, process plan, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Use of Hand Tools on Contoured Steels from CNC Milling Operations Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 2. General Machining and Bench Work
Duty Title: 2.6 Grind/Mill or Wire EDM All Other Details to Finished Size After Heat Treat

Duty:
Complete final sizing after heat treating.

Performance Standard:
Grind, mill, or wire EDM to finished size remaining heat-treated details and confirm all remaining dimensions.

Accuracy Level:
Finish machining tolerances to +/- .0005"

Assessment Equipment and Materials:
Workstation: Machine shop
Materials: As specified on bill of material
Tooling: Surface grinder, end grinder, rotary grinder, ID/OD grinder, mill, wire EDM hand grinder, and jig grinder
Measuring Equipment: Micrometer, calipers, scale, dial indicator, surface plate instruments, and depth micrometer
References: Detail prints, die design, process plan, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Grind/Mill or Wire EMD All Other Details to Finished Size After Heat Treat Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking	X	7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry	X	8.3 Materials
	3.0 Decision Making and Problem Solving	X	8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 3. Die Assembly
Duty Title: 3.1 Mount Form Steels, Form Pads, Nitrogen Units, and Pierce Station to Die Set

Duty:
Mount appropriate steels, pads, and nitrogen units needed for trim lines and forming.

Performance Standard:
Mount appropriate steels needed to establish trim-line development and/or form and bend development (part development required).

Accuracy Level:
Plus or minus .010" to +/- .0005" depending on the requirement of the specific detail

Assessment Equipment and Materials:
Workstation: Die assembly area and machine shop
Materials: Die details as noted on bill of material
Tooling: Radial arm drill, appropriate drill bits and reamers, transfer Punches, and assorted hand tools
Measuring Equipment: Straight edge, gage blocks, calipers, dial indicator, and height gage
References: Die design, process plan, detail prints, part prints, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Mount Form Steels, Form Pads, Nitrogen Units, and Pierce Station to Die Set Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry	X	8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements as Applied to Die Building

Duty Area: 3. Die Assembly
Duty Title: 3.2 Dry Run Die to Stop Blocks

Duty:
Dry run die to stop blocks.

Performance Standard:
Prior to assembling die springs and nitrogen cylinders and filling nitrogen manifolds, the upper die shoe and lower die shoe should be assembled and run together to the stop blocks to check for interference between upper and lower die steels.

Accuracy Level: N/A

Assessment Equipment and Materials:
Workstation: Bench and Die assembly area with overhead hoist
Materials: N/A
Tooling: N/A
Measuring Equipment: N/A
References: Die design, process plan, detail prints, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Dry Run Die to Stop Blocks Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 3. Die Assembly
Duty Title: 3.3 Assemble Die for Development Process

Duty:
Perform die assembly to confirm the development process.

Performance Standard:
After completing the dry run process, install required nitrogen cylinders, die springs, and nitrogen manifold.

Accuracy Level:
As required per die design

Assessment Equipment and Materials:
Workstation: Die assembly area
Materials: As specified on bill of material
Tooling: Assorted hand tools as required
Measuring Equipment: N/A
References: Die design and process plan, detail and assembly prints, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Assemble Die for Development Process Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	1. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
			11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 4. First Tryout
Duty Title: 4.1 Set Up Die in Tryout Press

Duty:
Set up die tryout and run first part samples.

Performance Standard:
After setting die on press bolster, follow press operation safety procedures and clamp upper and lower die shoes to the ram and bolster. Establish proper shut-height setting. Run first part samples.

Accuracy Level:
.010" to .060" off stop blocks

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: Tryout stock per part print specification
Tooling: Bolts, tee nuts, washers, fulcrum blocks, hex nuts or bolts, parallel, as required, and wrenches
Measuring Equipment: Micrometers, scales, and feeler gages
References: Safety operating procedures for punch press, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Set Up Die in Tryout Press Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 4. First Tryout
Duty Title: 4.2 Spot Form Steels

Duty:
Spot form steels as required.

Performance Standard:
Spot form steels and form pads to achieve the specified surface finish, surface tolerance, and station timing as required from form.

Accuracy Level:
As required by customer requirements and part print specifications

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: Tryout stock as specified on part print
Tooling: Hand grinder, spotting blue, and assorted hand stones and polishing wheels as required
Measuring Equipment: Micrometer
References: *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Spot Form Steels Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 4. First Tryout
Duty Title: 4.3 Develop Draws and Forms

Duty:
Develop draws and forms.

Performance Standard:
Rework, draw, and form stations as required to eliminate tears, wrinkles, and spring-back to meet part print specifications. Maintain a record of changes made.

Accuracy Level:
As determined by the part print specifications

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: Die and tryout stock as specified on part print, spotting blue, hand grinder, assorted hand stones, and shim stock
Tooling: Draw die, draw stations, form die, and form stations
Measuring Equipment: Micrometer, CMM, calipers, height gage, and scale
References: Part print, *Machinery's Handbook,* and customer specifications

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Develop Draws and Forms Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork	X	9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving	X	9.4 Draw Radii Use
	6. Engineering Drawings and Sketches	X	9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 4. First Tryout
Duty Title: 4.4 Develop Trim Lines

Duty:
Develop trim lines.

Performance Standard:
Establish proper size and configuration of the blank required to make the die part meet customer part print.

Accuracy Level:
As noted on the part print

Assessment Equipment and Materials:
Workstation: Workbench and tryout press
Materials: Sheet metal as specified on part print
Tooling: Band saw, laser burner, plasma cutter, wire burner, filing machine, and profile grinder
Measuring Equipment: Scale, calipers, and height gage
References: Die model, part print, customer standards, layout reports, checking fixture, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Develop Trim Lines Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 4. First Tryout
Duty Title 4.5 Validate Part

Duty:
Validate part to print.

Performance Standard:
Using appropriate tooling and measuring devices, verify part conformance to print.

Accuracy Level:
As noted on the part print and in customer requirements

Assessment Equipment and Materials:
Workstation: Workbench and tryout press
Materials: As specified on part print
Tooling: Checking fixtures, die models, and templates
Measuring Equipment: Micrometers, height gages, calipers, protractor, and CMM
References: Die model, part print, customer standards, layout reports, checking fixture, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Validate Part Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking	X	7.3 Surface Plate Instruments
X	1.4 Listening	X	7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints	X	10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 5. Final Assembly
Duty Title: 5.1 Make Adjustments As Determined from First Tryout

Duty:
Make final adjustments as determined from first tryout.

Performance Standard:
Access the required changes and adjustments from the first tryout including such things as timing feed problems and clearance issues (part development required). Maintain a record of the changes made.

Accuracy Level: N/A

Assessment Equipment and Materials:
Workstation: Die assembly area and workbench
Materials: N/A
Tooling: Assorted hand tools and standard tool room equipment
Measuring Equipment: Micrometer, scale, and calipers
References: Die design, layout report, customer requirements, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Make Adjustments As Determined from First Tryout Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 5. Final Assembly
Duty Title: 5.2 Mount All Remaining Die Details to Die Set

Duty:
Mount remaining die details to the die set.

Performance Standard:
Assemble all remaining details and assure proper trim and form clearances
(part development required).

Accuracy Level:
Plus or minus .010" to plus or minus .0005" depending on the requirement of the specific detail.

Assessment Equipment and Materials:
Workstation: Die assembly area
Materials: As specified on bill of material
Tooling: Standard tool room equipment and assorted hand tools
Measuring Equipment: Micrometer, scale, indicator, straight edge, and gage blocks
References: Process plan, die design, detail prints, part print, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Mount All Remaining Die Details to Set Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 5. Final Assembly
Duty Title: 5.3 Dry Run Die to Stop Blocks

Duty:
Dry run die to stop blocks.

Performance Standard:
Prior to assembling die springs and nitrogen cylinders and filling nitrogen manifolds, the upper and lower die shoes should be assembled and run together to the stop blocks to check for interference between upper and lower die steels (part development required).

Accuracy Level: N\A

Assessment Equipment and Materials:
Workstation: Die assembly area
Materials: Upper and lower die shoes with all die steels mounted
Tooling: N/A
Measuring Equipment: N/A
References: Die design, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Dry Run Die to Stop Blocks Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing		7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 5. Final Assembly
Duty Title: 5.4 Assemble Die for Final Tryout

Duty:
Perform final die assembly.

Performance Standard:
After completing the dry run process, complete the assembly of the die including nitrogen cylinders, die springs, and parallels as required (part development required).

Accuracy Level:
As required per die design

Assessment Equipment and Materials:
Workstation: Die assembly area
Materials: As specified on bill of materials
Tooling: Assorted hand tools
Measuring Equipment: N/A
References: Die design and process plan, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Assemble Die for Final Tryout Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
			11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 6. Final Tryout
Duty Title: 6.1 Set Up All Dies in Tryout Press

Duty:
Set up all dies for tryout in the tryout press.

Performance Standard:
After setting the die on press bolster, follow press operation safety procedures and clamp upper and lower die shoes to the ram and bolster. Establish proper shut-height setting.

Accuracy Level:
.010" to .060" off stop blocks

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: Tryout stock as specified on part print specification
Tooling: Bolts, tee nuts, fulcrum blocks, hex nuts or bolts, parallels as required, and wrenches
Measuring Equipment: N/A
References: Punch press safety operation procedures, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Set Up All Dies in Tryout Press Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
			11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 6. Final Tryout
Duty Title: 6.2 Perform Corrective Actions Required to Assure Stamped Part Conformance

Duty:
Make necessary adjustments to meet part print requirements.

Performance Standard:
Reviewing the layout reports and capability studies with engineering and quality control personnel, make the necessary adjustments to the die as required to assure that the part meets all part print requirements. Maintain a record of the changes made.

Accuracy Level:
As specified in part print

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: N/A
Tooling: Hand grinder, surface grinder, milling machine, and assorted hand tools
Measuring Equipment: Micrometers, calipers, scale, and height gage
References: Part print, layout report, customer requirements, and *Machinery's Handbook*

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Perform Corrective Actions Required to Assure Stamped Part Conformance Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading	X	7.1 Basic Measuring Instruments
X	1.2 Writing	X	7.2 Precision Measuring Instruments
X	1.3 Speaking	X	7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics	X	7.5 Metric Measurement and Conversion
X	2.1 Arithmetic		**8. Metalworking Theory**
X	2.2 Applications of Geometry	X	8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra	X	8.2 Basic CNC Operation
X	2.4 Applications of Trigonometry	X	8.3 Materials
	3. Decision Making and Problem Solving	X	8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
X	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 6. Final Tryout
Duty Title: 6.3 Assure Production Readiness of Die or Tool

Duty:
Confirm production readiness of the die or tool.

Performance Standard:
Referencing customer standards and die design, assure that all stock feeding problems have been resolved, all slugs fall freely from the die and down the scrap chutes or between parallels, and that the part falls freely from die in cut-off station when applicable.

Accuracy Level: N\A

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: As specified on bill of materials
Tooling: N/A
Measuring Equipment: N/A
References: Customer standards and die design

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Assure Production Readiness of Die or Tool Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading		7.1 Basic Measuring Instruments
X	1.2 Writing		7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics		7.5 Metric Measurement and Conversion
	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills		9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Duty Area: 6. Final Tryout
Duty Title: 6.4 Participate in Final Runoff

Duty:
Participate with engineering personnel in a final runoff, and make adjustments as needed.

Performance Standard:
Assist in the runoff process at the customer's facility, or in-house if a customer facility runoff is not required. Make any final die adjustments at this time. Verify that all documentation is complete and current, including prints, material specifications, and tooling.

Accuracy Level:

Per customer specifications and part print specification

Assessment Equipment and Materials:
Workstation: Tryout press
Materials: As specified on part print and in customer requirements
Tooling: Tryout press
Measuring Equipment: Scale and micrometer
References: Layout reports, capability studies, part print, and customer standards

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performance of the Participate in Final Runoff Duty.

	1. Written and Oral Communications		**7. Measurement**
X	1.1 Reading		7.1 Basic Measuring Instruments
X	1.2 Writing		7.2 Precision Measuring Instruments
X	1.3 Speaking		7.3 Surface Plate Instruments
X	1.4 Listening		7.4 Basic CMM Operation (Manual)
	2. Mathematics		7.5 Metric Measurement and Conversion
	2.1 Arithmetic		**8. Metalworking Theory**
	2.2 Applications of Geometry		8.1 Cutting Tool Technology and Theory
	2.3 Applications of Algebra		8.2 Basic CNC Operation
	2.4 Applications of Trigonometry		8.3 Materials
	3. Decision Making and Problem Solving		8.4 Basics of EDM, Wire, and Sinker Categories
X	3.1 Applications of Basic Problem Solving		**9. Metalforming Theory**
	4. Social Skills and Personal Qualities		9.1 Simple Blanking Pressures
X	4.1 Social Skills and Basic Teamwork		9.2 Simple Forming Pressures
	5. Mechanical Skills	X	9.3 Nitrogen Manifolds and Their Applications
X	5.1 Applications of Basic Mechanical Problem Solving		9.4 Draw Radii Use
	6. Engineering Drawings and Sketches		9.5 Basics of Draw Beads and Their Use
X	6.1 Standard Orthographic Prints		**10. Computers**
	6.2 GD&T Orthographic Prints		10.1 Basic Computer Operations
	6.3 Basic CAD Skills		**11. Safety and Environment**
		X	11.1 Safe Operation of All Tool and Die Shop Equipment
		X	11.2 Hazardous Materials Disposal
		X	11.3 OSHA Requirements As Applied to Die Building

Knowledge, Skills, Abilities, and Other Characteristics

KSAO Area: 1. Written and Oral Communications
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	Process plan preparation	Read prints. Read customer specifications. Read handbook.
2. Machining and benchwork	Machine details Layout	Read prints. Read handbook. Read process plans.
3. Die assembly	Installation and assembly of die components	Read prints. Read inspection plan. Read sampling plan. Read job instructions.
4. First tryout	Process adjustment Participation in improvement	Read prints. Read process control charts. Read team documents.
5. Final assembly and tryout	Installation of remaining details and peripherals	Read prints. Read manuals.
6. Safety and environment	Operations and handling Hazmat handling and storage Material storage	Read safety instructions.

KSAO Area: 1. Written and Oral Communications
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	Process plan preparation	Write instructions for process plan.
2. Machining and benchwork	Machine details Layout	Write a record of job activities.
3. Die assembly	Installation and assembly of die components	Write a record of assembly activities.
4. First tryout	Process adjustment Participation in improvement	Write a record of adjustment and improvement activities.
5. Final assembly and tryout	Installation of remaining details and peripherals	Write a record of assembly activities. Fill out history forms.
6. Safety and environment	Operations and handling Hazmat handling and storage Material storage	Write safety instructions.

KSAO Area: 1. Written and Oral Communications
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	Process plan preparation	Explain the process plan.
2. Machining and benchwork	Machine details Layout	Explain job execution activities.
3. Die assembly	Installation and assembly of die components	Explain assembly activities.
4. First tryout	Process adjustment Participation in improvement	Propose process remedies. Explain corrective actions. Explain process control charts.
5. Final assembly and tryout	Installation of remaining details and peripherals	Explain final assembly procedures. Explain final tryout procedures.
6. Safety and environment	Operations and handling Hazmat handling and storage Material storage	Explain safety instructions.

KSAO Area: 1. Written and Oral Communications
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	Process plan preparation	Receive, interpret, and follow verbal instructions.
2. Machining and benchwork	Machine details Layout	Receive, interpret, and follow verbal instructions.
3. Die assembly	Installation and assembly of die components	Receive, interpret, and follow verbal instructions.
4. First tryout	Process adjustment Participation in improvement	Receive, interpret, and follow verbal instructions.
5. Final assembly and tryout	Installation of remaining details and peripherals	Receive, interpret, and follow verbal instructions.
6. Safety and environment	Operations and handling Hazmat handling and storage Material storage	Receive, interpret, and follow 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	Process plan preparation	Calculate die construction time.
2. Machining and benchwork	Machine details Layout	Calculate speeds and feeds.
3. Die assembly	Installation and assembly of die components	Calculate necessary dimensions from a print.
4. First tryout	Process adjustment Participation in improvement	Calculate necessary changes in dimensions.
5. Final assembly and tryout	Installation remaining details and peripherals	Calculate adjustments needed. Calculate statistics required by control charts.
6. Safety and environment	Operations and handling Hazmat handling and storage Material storage	Calculate the volume of materials stored.

KSAO Area: 2. Mathematics
KSAO: 2.2 Applications of Geometry

KSAO Definition:
Understands and applies basic geometric concepts and terminology that form the analytical foundation of job planning and execution, including planes perpendicularity, Cartesian coordinates, concentricity, parallelism, straightness, flatness, circularity, and symmetry.

Performance Requirement:
Given a specific duty to perform requiring understanding and using geometric concepts and terminology, perform the required duty and answer questions about the meaning and use of geometric principles.

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Apply geometry to select and sequence operations to meet part dimensions.
2. Machining and benchwork	Machine details Layout	Apply geometry to hold the work appropriately. Apply geometry to locate centerlines.
3. Die assembly	Installation and assembly of die components	Apply geometry to locate surfaces and centerlines.
4. First tryout	Process adjustment Participation in improvement	Apply geometry in analyzing operations and sequences.
5. Final assembly and tryout	Installation of remaining details and peripherals	Apply geometry in analyzing operations and sequences.

KSAO Area: 2. Mathematics
KSAO: 2.3 Applications of Algebra

KSAO Definition:
Uses standard formulas and arithmetic operations to make required calculations with or without a calculator. Can solve for an unknown in a trade formula.

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

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Use trade formulas.
2. Machining and benchwork	Machine details Layout	Use trade formulas.
3. Die assembly	Installation and assembly of die components	Use trade formulas.
4. First tryout	Process adjustment Participation in improvement	Use trade formulas.
5. Final assembly and tryout	Installation of remaining details and peripherals	Use trade formulas.

KSAO Area: 2. Mathematics
KSAO: 2.4 Applications of Trigonometry

KSAO Definition:
Uses standard formulas and arithmetic operations to make required calculations with or without a calculator, solving for unknowns in right triangles.

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

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Use trig-based formulas.
2. Machining and benchwork	Machine details Layout	Use trig-based formulas.
3. Die assembly	Installation and assembly of die components	Use trig-based formulas.
4. First tryout	Process adjustment Participation in improvement	Use trig-based formulas.
5. Final assembly and tryout	Installation of remaining details and peripherals	Use trig-based formulas.

KSAO Area: 3. Decision Making and Problem Solving
KSAO: 3.1 Applications of 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 Applications of Basic Problem Solving KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Sequence operations, providing alternatives according to availability of tools and equipment.
2. Machining and benchwork	Machine details Layout	Follow a process plan developing new methods where required.
3. Die assembly	Installation and assembly of die components	Follow a process plan developing new methods where required.
4. First tryout	Process adjustment Participation in improvement	Follow a process plan developing new methods where required.
5. Final assembly and tryout	Installation of remaining details and peripherals	Follow a process plan developing new methods where required.

KSAO Area: 4. Social Skills and Personal Qualities
KSAO: 4.1 Social Skills and Basic Teamwork

KSAO Definition:
Identifies and demonstrates the appropriate social skills and related personal qualities in the performance of major duties requiring cooperative relations with supervisors, team leaders, and team members.

Performance Requirement:
Demonstrate understanding, friendliness, politeness, and empathy toward others, including men, women, and people from various ethnic, social, and educational backgrounds. Work cooperatively with others and contributes to group efforts with ideas, suggestions, and positive feedback to group members. Demonstrate appropriate social and communication skills in resolving conflicts with supervisors, team leaders, and team members.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Social Skills and Basic Teamwork KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Work cooperatively in developing a process plan, taking input from supervisors and co-workers.
2. Machining and benchwork	Machine details Layout	Work cooperatively by responding to the need to share common work stations and equipment.
3. Die assembly	Installation and assembly of die components	Work cooperatively by responding to the need to share common work stations and equipment.
4. First tryout	Process adjustment Participation in improvement	Work cooperatively by responding to the need to share common work stations and equipment.
5. Final assembly and tryout	Installation of remaining details and peripherals	Work cooperatively by responding to the need to share common work stations and equipment.

KSAO Area: 5. Mechanical Skills
KSAO: 5.1 Applications of Basic Mechanical Problem Solving

KSAO Definition:
Understand and explain various mechanical devices.

Performance Requirement:
Be able to explain the effect of friction and the impact of a lack of lubrication. Explain the functions of gear ratios, levers, fulcrums, and pulleys. Describe the meaning of pressures and thrust.

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Determine lubricant requirement.
2. Machining and benchwork	Machine details Layout	Apply mechanical principles to diemaking.
3. Die assembly	Installation and assembly of die components	Apply mechanical principles to diemaking.
4. First tryout	Process adjustment Participation in improvement	Apply mechanical principles to diemaking.
5. Final assembly and tryout	Installation of remaining details and peripherals	Apply mechanical principles to diemaking.

KSAO Area: 6. Engineering Drawings and Sketches
KSAO: 6.1 Standard Orthographic Prints

KSAO Definition:
Interprets orthographic prints.

Performance Requirement:
Given a standard print 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 Prints KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Gather geometric and dimensional data from a print to sequence operations.
2. Job execution	Benchwork Layout	Gather geometric and dimensional data from a print to perform a layout.
3. Quality and inspection	Inspection control	Gather geometric and dimensional data from a print to carry out the inspection of a finished part.

KSAO Area: 6. Engineering Drawings and Sketches
KSAO: 6.2 GD&T Orthographic Prints

KSAO Definition:
Interprets GD&T orthographic prints.

Performance Requirement:
Given a GD&T print 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 GD&T Orthographic Prints KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Gather geometric and dimensional data from a GD&T print to sequence operations.
2. Job execution	Benchwork Layout	Gather geometric and dimensional data from a GD&T print to perform a layout.
3. Quality and inspection	Inspection control	Gather geometric and dimensional data from a GD&T print to carry out the inspection of a finished part.

KSAO Area: 6. Engineering Drawings and Sketches
KSAO: 6.3 Basic CAD Skills

KSAO Definition:
Accesses part drawings and designs in a simple CAD system.

Performance Requirement:
Is able to access CAD drawings in standard programs and read part dimensions and configurations.

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Access part drawings using CAD.
2. Job execution	Die building	Interpret CAD drawings.

KSAO Area: 7. Measurement
KSAO: 7.1 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 print 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 Measuring Instruments KSAO.

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

KSAO Area: 7. Measurement
KSAO: 7.2 Precision Measuring Instruments

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

Performance Requirement:
Given a print and a finished part from that print, as well as a selection of calibrated 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	Determine dimensional accuracy of die details using precision measuring instruments.
3. Quality and inspection	Inspection control	Inspect dimensions of a finished part that calls for use of precision measuring tools.

KSAO Area: 7. Measurement
KSAO: 7.3 Surface Plate Instruments

KSAO Definition:
Recognizes and applies appropriately precision tools and instruments for surface plate work such as precision angle plates and tool blocks, precision transfer gages, and precision height gages.

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

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

Duty Area	Task	Activity
3. Quality and inspection	Inspection control	Inspect part using surface plate instruments.

KSAO Area: 7. Measurement
KSAO: 7.4 Basic CMM Operation (Manual)

KSAO Definition:
Applies the capacities of a manual coordinate measuring machine (CMM) to inspect a part.

Performance Requirement:
Inspect a part of appropriate complexity using a manual coordinate measuring machine (CMM), and establish data, multiple planes, multiple surfaces, hole locations, hole sides, and angle.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Basic CMM Operation (manual) KSAO.

Duty Area	Task	Activity
1. Quality and inspection	Inspection with CMM	Inspect part.

KSAO Area: 7. Measurement
KSAO: 7.5 Metric Measurement and Conversion

KSAO Definition:
Reviews a part specification given in metrics and is able to convert to English measures.

Performance Requirement:
Given a print and a part to be made with metric dimensions, demonstrate the ability to convert the metrics to English measures.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Metric Measurement and Conversion KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Reference part prints and customer specifications for a metric part design.
2. Job execution	Die building	Reference die details and customer standards.

KSAO Area: 8. Metalworking Theory
KSAO: 8.1 Cutting Tool Technology and Theory

KSAO Definition:
Understands the basics of heat, shock, friction, zone of distortion, cutting interface, machinability, cutter presentation, cutter geometry, and chip-holding capacity as they relate to machining applications.

Performance Requirement:
Given a print and a part to be made, select speeds, feeds, and appropriate tooling to carry out the manufacture of the part.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Know Cutting Tool Technology and Theory KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Determine speeds and feeds.
2. Job execution	Benchwork Layout Machine tools operation	Select cutters appropriate to machine operations.

KSAO Area: 8. Metalworking Theory
KSAO: 8.2 Basic CNC Operation

KSAO Definition:
Uses and applies the concepts of CNC machine tool operation.

Performance Requirement:
Explain the role of the control, the mechanical components, and the tooling in the function and output of a CNC machine tool.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Know Basic CNC Operation KSAO.

Duty Area	Task	Activity
2. Job execution	Understanding basic operation of CNC mills, lathes, and wire EDM	Properly prepare for CNC operation.

KSAO Area: 8. Metalworking Theory
KSAO: 8.3 Materials

KSAO Definition:
Recognizes common materials and their principal properties relevant to diemaking and machining tasks. Recognizes differences between ferrous and non-ferrous, magnetic, and ductile materials. Understands the changes that heat-treat imparts to materials.

Performance Requirement:
Given a print and a part to be manufactured, predict the part's machinability based upon appearance, call-out on the print, and supplied hardness value.

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

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Predict speeds and feeds, as well as tooling requirements, based on known properties of a material.
2. Job execution	Benchwork Layout	Respond to cutting conditions imposed by material properties as predicted by process plan and actually experienced in machining material.

KSAO Area: 8. Metalworking Theory
KSAO: 8.4 Basics of EDM, Wire, and Sinker Categories

KSAO Definition:
Recognizes which category of EDM process can produce the required component with the highest precision and efficiency.

Performance Requirement:
Given a component to be made, select from the configuration the best EDM technique for producing the part to specifications.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Understand Basics of EDM, Wire, and Sinker Categories KSAO.

Duty Area	Task	Activity
1. Job planning	Process plan preparation	Select appropriate EDM process for a given set of parts to be made.
2. Job execution	Benchwork Layout Machine tools operation	Properly prepare details for wire and sinker EDM processes.

KSAO Area: 9. Metalforming Theory
KSAO: 9.1 Simple Blanking Pressures

KSAO Definition:
Calculates blanking pressure required in preparing for part production.

Performance Requirement:
Given a part to be made, determine blanking pressure required for preparing part.

Duty Standard Cross Reference Table:
This table identifies some of the activities in the Calculate Simple Blanking Pressures KSAO.

Duty Area	Task	Activity
1. Job planning	Verification of required blanking pressure	Calculate required blanking pressures.
2. Job execution	Determination of punch shear requirement	Calculate blanking pressures.

KSAO Area: 9. Metalforming Theory
KSAO: 9.2 Simple Forming Pressures

KSAO Definition:
Calculates press needed to form a part.

Performance Requirement:
Given a part to be made, determine required forming pressure to produce part while minimizing stress.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Calculate Simple Forming Pressures KSAO.

Duty Area	Task	Activity
2. Job execution	Die building	Determine forming pressure requirements.

KSAO Area: 9. Metalforming Theory
KSAO: 9.3 Nitrogen Manifolds and Their Applications

KSAO Definition:
Understands the use of manifolds in pressure control.

Performance Requirement:
Given a part to be made, determine if the use of a manifold would assist in providing a more uniform application of pressure during forming.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Understand Nitrogen Manifolds and Their Applications KSAO.

Duty Area	Task	Activity
1. Job planning	Safety plan preparation	Inspect work area and describe any corrections needed to improve safety.
2. Job execution	Die building	Demonstrate ability to employ safe practices.

KSAO Area: 9. Metalforming Theory
KSAO: 9.4 Draw Radii Use

KSAO Definition:
Understand the function of a draw radii in reducing part failure.

Performance Requirement:
Determine the use of a draw radii in eliminating cracking, wrinkling, and other part defects.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Understand the Use of Draw Radii KSAO.

Duty Area	Task	Activity
1. Job planning	Confirmation of proper draw radii on draw cavity of die	Determine proper draw radii on cavity.
2. Job execution	Machining of proper radii on draw cavity	Determine proper draw radii; rework as needed to correct defects.

KSAO Area: 9. Metalforming Theory
KSAO: 9.5 Basics of Draw Beads and Their Use

KSAO Definition:
Explains the use of draw beads to control material flow.

Performance Requirement:
Describe the role that draw beads can play in reducing part failure such as cracks, wrinkles, or folds.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Understand Basics of Draw Beads and Their Use KSAO.

Duty Area	Task	Activity
1. Job planning	Verification of die design	Determine if beads are required in draw station.
2. Job execution	Die building	Rework as needed to make panel free of defects.

KSAO Area: 10. Computers
KSAO: 10.1 Basic Computer Operations

KSAO Definition:
Boots up and accesses a database.

Performance Requirements:
Explain the computer system being used and demonstrate the ability to access a CAD drawing.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Understand Basic Computer Operations KSAO.

Duty Area	Task	Activity
1. Job planning	Accessing a system	Access a system to view die design and part data.
2. Job execution	Die building	Access a CAD system and identify die design and part data.

KSAO Area: 11. Safety and Environment
KSAO: 11.1 Safe Operation of All Tool and Die Shop Equipment

KSAO Definition:
Knows the hazards in operating machine tools. Can identify and explain the purpose and information contained in machine operating manuals.

Performance Standard:
Is able to explain the proper operation of machine tools.

Duty Standard Cross Reference Table:
This table identifies some activities that require the Understand the Safe Operation of All Tool and Die Shop Equipment KSAO.

Duty Area	Task	Activity
1. Job planning	Preparation of plan for safe operation of all machine tools	Review and identify potential job hazards.

KSAO Area: 11. Safety and Environment
KSAO: 11.2 Hazardous Materials Disposal

KSAO Definition:
Knows the hazards of materials used in the manufacture of machine tools.

Performance Requirement:
Be able to explain the proper handling and disposal of toxic and other hazardous materials such as the types of cutting fluids, coolants, and lubricants.

Duty Standard Cross Reference Table:
This table identifies some of the activities that require the Understanding Hazardous Materials Disposal KSAO.

Duty Area	Task	Activity
1. Job planning	Safety plan preparation	Identify all potential safety hazards in handling materials.
2. Job execution	Die building	Identify all potential disposal problems in scrap materials and fluids per EPA regulations.

KSAO Area: 11. Safety, Health, and Environment
KSAO: 11.3 OSHA Requirements As Applied to Die Building

KSAO Definition:
Knows and can explain safe operating practices.

Performance Requirement:
Is familiar with and can explain the requirements of the following safety standards and regulations: all applicable OSHA requirements and American National Standards B11.19 and B11.20 A Machine Tool Safety Standards.

Duty Standards Cross Reference Table:
This table identifies some of the activities that require the Understanding OSHA Requirements as Applied to Die Building KSAO.

Duty Area	Task	Activity
1. Job planning	Safety plan preparation	Inspect work area and describe any corrections needed to improve safety.
2. Job execution	Die building	Demonstrate ability to employ safe practices.

Appendix A

Duties and Standards

For

Machining Skills ¾ Level II

The National Institute for Metalworking Skills, Inc. (NIMS)

A Level II diemaker is expected to possess all the skills listed in the *Duties and Standards for Machining Skills ¾ Levels I and II.* The following pages describe the specific duties (taken from the standards) considered by the technical work group to be the minimum requirement for a Level II diemaker. A description of the duty area and duty title only is given. For a complete list of the requirements, see *Duties and Standards for Machining Skills ¾ Level II.*

Duty Area: 1. Job Process Planning
Duty Title: 1.1 Develop a Process Plan

Duty:
Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, grinding, EDM, polishing, and quality assurance.

Performance Standard:
Given a part with a finished layout and access to appropriate machine tools, produce an operation sheet detailing the process plan and required speeds and feeds. Provide sketches and special instructions as needed.

Accuracy Level: N/A

Duty Area: 2. Job Execution
Duty Title: 2.3 Turning Operations: Perform Between Centers Cylindrical and Taper Turning

Duty:
Set up and perform between centers turning for straight, cylindrical, and tapered turning by offsetting the tailstock.

Performance Standard:
Given raw material, a process plan, print, hand, precision, and cutting tools, as well as access to an appropriate turning machine and its accessories, produce a part matching the process plan and the print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least two straight diameters within +/-.001, an appropriate taper at each end of the part, and require a reversal of the part end for end.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print. Diameters to be concentric within .001 T.I.R. Surface finish should be 63 microinches or better.

Duty Area: 2. Job Execution
Duty Title: 2.4 Production: Operate a Turning Machine

Duty:
Set up and operate a turning machine to produce a collection of parts.

Performance Standard:_
Given a turning machine, part print, necessary tooling, and material, produce a group of parts to required specifications. The part should be similar to a shoulder bushing. The major OD should be 1", the minor OD .750, the ID ½", and the overall length should be 1¼". The lot size should be 15.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print. Diameters should be concentric within .001 T.I.R.

Duty Area: 2. Job Execution
Duty Title: 2.5 Turning Operations: Chucking, OD and ID Tapers Using a Taper Attachment

Duty:
Set up and perform tapered boring and turning using a taper attachment.

Performance Standard:
Given raw material, a process plan, a print, hand, precision, and cutting tools, as well as access to an appropriate turning machine with a taper attachment and its accessories, produce a part matching the process plan and the print specifications using appropriate trade techniques and speeds and feeds. The part specified should have at least two diameters within +/-.002, one bore within +/-.002, one external and one internal taper, and require at least two chuckings or other workholding setup.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print. Diameters to be concentric within .003 T.I.R.

Duty Area: 2. Job Execution
Duty Title: 2.6 Milling: Square Up a Block

Duty:
Set up and square up the six surfaces of a block to within +/- .002 and .002 over 4" squareness.

Performance Standard:
Given raw material, a process plan, a print, hand, precision, and cutting tools, as well as access to an appropriate milling machine and its accessories, produce a part matching the process plan and the print specifications. The part will require squaring-up from the raw state.

Accuracy Level: +/-.002 on all decimals unless otherwise specified on the print. Surfaces should be square within .002 over 4". Surface finish should be 63 microinches.

Duty Area: 2. Job Execution
Duty Title: 2.7 Vertical Mill: Perform Precision Boring

Duty:
Set up and perform boring for location, size, and finish.

Performance Standard:
Produce three bores to specification. The part will specify 3 holes in a 1" plate. The holes will be between ¾" and 1½" to locations within +/-.001 and hold diameters within +/-.0005. One hole is to be counterbored to a decimal depth holding +/-.002 and counterbore diameter within +/-.005.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print

Duty Area: 2. Job Execution
Duty Title: 2.8 Milling: Use Rotary Tables

Duty:
Set up and perform the development of surfaces at a specified non-right angle using a rotary table. Set up and establish hole locations in various relationships to one another using a rotary table. The holes are in the same plane. Establish the profile of a radius with respect to two surfaces and the connecting points of tangency.

Performance Standard:
Given raw material, a process plan, a print, hand, precision, and cutting tools, as well as access to an appropriate milling machine, an appropriately sized rotary table and accessories, produce a part matching the process plan and the print specifications. The part specified will require two groups of holes arrayed on bolt circles and several surfaces at various angles to one another.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print

Duty Area: 2. Job Execution
Duty Title: 2.10 Milling: Divide Head Operations

Duty:
Set up and perform operations requiring a dividing head. Set up and establish hole locations in various relationships to one another using a dividing head. Establish the profile of a radius with respect to two surfaces and the connecting points of tangency.

Performance Standard:
Given raw material, a process plan, a print, hand, precision, and cutting tools, as well as access to an appropriate milling machine, an appropriately sized dividing head and accessories, produce a part matching the process plan and the print specifications. The part specified will require two groups of holes arrayed on an outer diameter, as well as several surfaces at various angles to one another.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print.

Duty Area: 2. Job Execution
Duty Title: 2.11 Machine Tool Power Tapping: Taper Reaming and Pipe Tapping

Duty:
Set up and perform taper reaming and subsequent pipe tapping.

Performance Standard:
Set up, drill, taper ream, and tap a series of holes to print specification.

Accuracy Level: +/- .015 on all fractions, +/-.005 on all decimals unless otherwise specified on the print. Diameter of tapped hole +/- #2 thread on the required pipe thread plug gage.

Duty Area: 2. Job Execution
Duty Title: 2.12 Surface Grinding: Finish Flats to +/-.0005

Duty:
Grind a block's six faces to finished dimensions having tolerances of +/-.0005 and squareness of .0005 over 4", and 32 microinches surface finish. Dress the wheel as necessary.

Performance Standard:
Given a block squared up on a mill, hardened to 55 to 60 R_c, a process plan, a print, hand and precision tools, and choice of a grinding wheels, as well as access to a surface grinder and its accessories, dress the wheel, produce a part matching the process plan and the print specifications using appropriate trade techniques. The part specified will be in the semi-finished state having been squared up. Finishing the part will require precision finishing the six faces of the block to tolerances common to precision grinding for squareness, size, and surface finish characteristics.

Accuracy Level: +/- .0005 on all decimals unless otherwise specified on the print. Square within .0005 over 4".

Duty Area: 2. Job Execution
Duty Title: 2.13 Surface Grinding: Finish Flats at Simple Angles

Duty:
Set up and perform the finish surface grinding of flat surfaces at simple angles with respect to one another. Dress the wheel as necessary.

Performance Standard:
Given a block roughed out on a mill, a process plan, a print, hand and precision tools, and choice of grinding wheels, as well as access to a surface grinder and its accessories, dress the wheel and grind the specified angled surfaces to a finish matching the process plan and the print specifications. The part specified will be in the semi-finished state having been roughed out. Finishing the part will require precision finishing the specified surfaces of the block to tolerances common to precision grinding for squareness, size, and surface finish characteristics.

Accuracy Level: +/- .0005 on all decimals unless otherwise specified on the print.
Square within .001 over 4". Angles to be held within +/-15'.

Duty Area: 2. Job Execution
Duty: 2.14 Prepare and Balance Grinding Wheel

Duty:
Set up, prepare, and balance a grinding wheel 14" or greater in diameter. Place the wheel into service.

Performance Standard:
Given a wheel and appropriate equipment, prepare the wheel to go into service. Mount the wheel and produce a surface finish of 32 microinches or better on a cylinder of CRS.

Accuracy Level: N/A

Appendix B

Technical Work Group
for
Duties and Standards for Diemaking Skills—Level II

Dennis Gill
Digital Tool and Die Company
Grandville, MI

Jerry Johnston
Progressive Die and Automation
Grand Rapids, MI

Daryl Magee
Progressive Tool Company
Waterloo, IA

Jeff Maurer
A-G Tool and Die Company
Miamitown, OH

David Peppin
Falcon Tool and Die Company
Ferrysburg, MI

Dave Ruthven
CTM
Grand Rapids, MI