Duties and Standards

for

Screw Machining--Level III

Single-and Multiple-Spindle Automatic Bar and Chucking Machines

Approved by

The National Institute for Metalworking Skills, Inc.

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Prepared by members of
The Precision Machined Products Association

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Screw Machining Skills-Level III

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Overview-Occupational Description and Benchmarks

This standard applies to what are commonly known in the industry as screw machines. A screw machine is the traditional terminology for single- and multiple-spindle automatic bar and chucking machines in which all tool movement is controlled by the machine. The machine is an adaptation of the traditional horizontal engine lathe and operates on similar machining principles.

For the purpose of this standard and to facilitate understanding, descriptions will be given in the traditional terminology of what is commonly known as an automatic screw machine.

Occupational Description

Level III skills are used by skilled tradespersons who have achieved proficiency in the setup and operation of single-and multiple-spindle automatic bar and chucking machines, commonly known as screw machines, and related tooling and equipment, quality skills related to screw machining, and some planning and job control skills related to screw machine work.

The following are the general areas of competency:

- Care and use of tooling
- Handling, use, and installation of materials and related fluids
- Installation of tooling, cams, and accessories
- Inspection and quality assurance skills
- Work planning and job control
- Teamwork

Safety is a responsibility that cuts across all competencies. Each competency has its own level of related safety. Skilled tradespersons are expected to know and execute correctly all matters related to safety for these competencies. Skilled screw machine operators may have modest training and supervision responsibilities for other operators or production workers. Screw machinists commonly perform their tasks as team members. Highly skilled screw machinists will often have team leadership responsibilities.

Job Planning and Tooling Skills

- Identify tooling.
- Stage tooling.
- Install tooling.
- Evaluate and maintain tooling.

Materials Handling

- Mount materials.
- Perform lubrication of screw machines.
- Install and deploy coolants on screw machines.

Inspection and Quality Assurance Skills

- Perform and document in-process inspection.
- Follow inspection plan.
- Use precision measuring instruments.

Setup and Operation of a Screw Machine

- Mount and adjust tooling.
- Hand off (turn over) with instructions to an operator.

Work Planning and Job Control Skills

- Monitor and troubleshoot processes.
- Communicate process plan to an operator.
- Revise procedures and tooling and equipment status.

Framework for Screw Machining Skills--Level III

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

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Duty Area: 1. Pre-Setup
Duty Title: 1.1 Verify Process Plan

Duty:
Review the process plan and confirm that the proper layout has been provided. Reconfirm calculations of proper speeds and feeds. Take appropriate action as necessary to notify supervision of any apparent deviations from specifications.

Performance Standard:
Given a blueprint and process plan detailing the machining operations by position, reconfirm that the plan is correct by calculating and recording the speeds and feeds for each tool. Be able to explain each position and identify all major components and their function required in producing a quality part.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Workbench
Material: As specified in process plan
Tooling: N/A
Measuring Instruments: N/A
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Verify Process Plan.

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

Duty Area: 1. Pre-Setup
Duty Title: 1.2 Stage Required Tooling for Production

Duty:
Given a process plan and part specifications, procure required tools, tool-holders, attachments, and accessories and prepare for installation.

Performance Standard:
Given a process plan and part specifications, procure required tools, tool-holders, attachments, and accessories. Inspect and verify tooling condition for proper use and refurbish as needed and as authorized.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Workbench
Material: As specified in process plan
Tooling: Tool holders, hand tools, and magnifying glass
Measuring Instruments: Dial indicators, gage blocks, micrometers, adjustable blocks, and feeler gages
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performing the Stage Required Tooling for Production Duty.

	1. Written and Oral Communications		**5. Engineering Drawings and Sketches**
X	1.1 Reading	X	5.1 Standard Orthographic Blueprints
X	1.2 Writing		5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurement**
X	1.4 Listening	X	6.1 Basic Measuring Instruments
	2. Mathematics		6.2 Precision Measuring Instruments
X	2.1 Arithmetic		**7. Metalworking Theory**
	2.2 Applications of Geometry		7.1 Cutting Theory
	2.3 Applications of Algebra		7.2 Material Properties
	2.4 Applications of Trigonometry		7.3 Lubricants, Cutting Fluids, and Coolants
	2.5 Applications of Statistics		
	3. Decision Making and Problem Solving		
X	3.1 Applying Decision Rules		
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 1. Pre-Setup
Duty Title: 1.3 Prepare Attachments and Accessories

Duty:
Prepare attachments and/or accessories for setup. Make necessary adjustments as authorized.

Performance Standard:
Given a process plan, inspect attachments and necessary accessories. Verify that they are in proper working order. If needed, disassemble/repair attachments or accessories and re-assemble for production of the parts specified.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Workbench
Material: As specified in process plan
Tooling: Tool-holders, lubrication devices, hand tools, and magnifying glass
Measuring Instruments: Dial indicators, gage blocks, micrometers, adjustable blocks, and feeler gages
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Prepare Attachments and Accessories Duty.

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

Duty Area: 2. Setup
Duty Title: 2.1 Prepare Machine for Setup

Duty:
Remove previous setup including tools, tool-holders, cams, collets, pushers, and other necessary attachments; clean tooling area and relieve all positive stops.

Performance Standard:
Clean, inspect, and return to storage crib all components used in the previous run. Relieve all stops and clean internal spindle area. Verify condition of cam followers and material feeding components.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Screw machine
Material: N/A
Tooling: Appropriate hand tools and miscellaneous brushes
Measuring Instruments: N/A
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Prepare Machine for Setup Duty.

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

Duty Area: 2. Setup
Duty Title: 2.2 Install Collets, Pushers, Cams, and Gears

Duty:
Install collets, pushers, cams, gears, and other devices called for in the process plan for the production run being set up.

Performance Standard:
Install and check correct clearances on cams and gears. Adjust tension on collets; perform a dry run to verify proper cycling and clearance settings.

Accuracy Level:
As specified in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, feeler gages, cam rolls, and lubricating devices
Measuring Instruments: N/A
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Install Collets, Pushers, Cams, and Gears Duty.

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

Duty Area: 2. Setup
Duty Title: 2.3 Adjust for Production

Duty:
Set end-tool slide pressure and check cycle time.

Performance Standard:
Verify cycle time and positions of low- and high-speed dogs and brake by cycling 10 times. Demonstrate a knowledge of the position and functions of high- and low-speed dogs and brakes. Given engineering drawings and the process plan; calculate the position of the stock stop.

Accuracy Level:
Correct calculation of stock stop dimension. Run 10 cycles within +/-2.5 percent of process plan cycle time.

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, calculator, and basic measuring instruments
Measuring Instruments: Stop watch
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Adjust for Production Duty.

	1. Written and Oral Communications		**5. Engineering Drawings and Sketches**
X	1.1 Reading	X	5.1 Standard Orthographic Blueprints
X	1.2 Writing	X	5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	X	6.1 Basic Measuring Instruments
	2. Mathematics	X	6.2 Precision Measuring Instruments
X	2.1 Arithmetic		**7. Metalworking Theory**
	2.2 Applications of Geometry		7.1 Cutting Theory
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	3. Decision Making and Problem Solving		
X	3.1 Applying Decision Rules		
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Setup
Duty Title: 2.4 Install Auxiliary Attachments

Duty:
Install common auxiliary attachments including threading, recessing, tapping, reaming, pick-off, and back-finishing attachments.

Performance Standard:
Given a process plan, install auxiliary attachments for the part specified. Verify proper installation and operation. Verify proper clearances and timing by dry cycling the machine.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools and lubrication devices
Measuring Instruments: Feeler gages and other measuring tools as appropriate
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Install Auxiliary Attachments Duty.

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

Duty Area: 2. Setup
Duty Title: 2.5 Install Tooling and Adjust Positive Stops on All Slides

Duty:
Install and adjust tool-holders and tooling for proper location and size to make the part to specifications. Verify holder tightness. Adjust all positive stops.

Performance Standard:
Given a process layout, install and adjust holders and tooling to specified linear and diametrical locations. Adjust end-tool slide and cross-slide positive stops for proper tension. Verify holder tightness and clearance using feeler gages.

Accuracy Level:
As specified in engineering drawings and process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Tool-holders and appropriate hand tools, tooling, and drying dye
Measuring Instruments: Feeler gages, dial indicators, micrometers, dial verniers, and optical comparator
Reference: Machinery's Handbook and machine specifications

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Install Tooling and Adjust Positive Stops on all Slides Duty.

	1. Written and Oral Communications		**5. Engineering Drawings and Sketches**
X	1.1 Reading	X	5.1 Standard Orthographic Blueprints
X	1.2 Writing	X	5.2 GDT Orthographic Blueprints
X	1.3 Speaking		**6. Measurements**
X	1.4 Listening	X	6.1 Basic Measuring Instruments
	2. Mathematics	X	6.2 Precision Measuring Instruments
X	2.1 Arithmetic		**7. Metalworking Theory**
	2.2 Applications of Geometry		7.1 Cutting Theory
	2.3 Applications of Algebra		7.2 Material Properties
	2.4 Applications of Trigonometry		7.3 Lubricants, Cutting Fluids, and Coolants
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	3. Decision Making and Problem Solving		
X	3.1 Applying Decision Rules		
X	3.2 Basic Problem Solving		
	4. Group Skills and Personal Qualities		
	4.1 Group Participation		
	4.2 Personal Qualities		

Duty Area: 2. Setup
Duty Title: 2.6 Adjust Pick-Off and Back-Finish Attachments

Duty:
Adjust pick-off and back-finish attachments on a single part.

Performance Standard:
Given an engineering drawing and a process plan, set the proper tension and depth for location by adjusting the pick-off attachment. Using the appropriate plug gage, adjust the pick-off collet tension. Verify the functioning of the attachment, the timing of the collet opening and closing, and the part ejection. Set the timing on the back-finish slide. Using proper gages confirm correct alignment between the pick-off and back-finish slides. Install the back-finish tooling and adjust to proper depth to meet part specifications.

Accuracy Level:
As specified on engineering drawings

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, plug gages, alignment gage, tooling, and hand mirror
Measuring Instruments: Dial indicator and appropriate inspection gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in performing the Adjust Pick-Off and Back-Finish Attachments Duty.

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

Duty Area: 2. Setup
Duty Title: 2.7 Adjust Recess Attachment

Duty:
Adjust recess attachment setting on a single part.

Performance Standard:
Given an engineering drawing and process plan, install tooling and set for proper height location. Adjust attachment for proper depth location and for specified depth of cut.

Accuracy Level:
As specified on engineering drawings and in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, tooling, mirror, and appropriate setting gages
Measuring Instruments: Dial indicator and appropriate inspection gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Adjust Recess Attachment Duty.

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

Duty Area: 2. Setup
Duty Title: 2.8 Adjust High-Speed Drilling Attachments

Duty:
Adjust high-speed drilling setting on a single part.

Performance Standard:
Given an engineering drawing and process plan, install tooling for the drilling operation. Adjust for proper depth and location. Calculate the feeds and speeds to confirm performance to the process plan. Dry cycle the setup to verify clearances and proper travel.

Accuracy Level:
As specified on engineering drawings and in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in the process plan
Tooling: Hand tools, tooling, and appropriate tool-holders
Measuring Instruments: Appropriate inspection gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performing the Adjust High-Speed Drilling Attachments Duty.

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

Duty Area: 2. Setup
Duty Title: 2.9 Adjust End-Working Reaming Tooling

Duty:
Adjust end-working reaming on a single part.

Performance Standard:
Given an engineering drawing and process plan, install reaming tooling. Adjust for proper depth location. Check and assure proper travel of the attachment by dry cycling the machine and measuring the stroke. Adjust tool-holder for proper alignment. Calculate the proper travel and gear ratios and dry cycle to insure clearances.

Accuracy Level:
As specified on engineering drawings and in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in the process plan
Tooling: Hand tools, tooling, mirror, appropriate tool-holder gages, and calculator
Measuring Instruments: Dial indicator and appropriate inspection gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Adjust End-Working Reaming Tooling Duty.

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

Duty Area: 2. Setup
Duty Title: 2.10 Adjust Threading and Tapping Tooling

Duty:
Adjust threading and tapping settings on a single part.

Performance Standard:
Given an engineering and process plan, install tapping and threading tooling. Adjust for proper depth location and set master stop.
Check and verify proper travel of the attachment by dry cycling the machine. Adjust tool-holder for proper alignment. Check the gear ratios and calculate the feeds and speeds.

Accuracy Level:
As specified on engineering drawings and in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, tooling, mirror, appropriate tool-holder gages, and calculator
Measuring Instruments: Dial indicator and appropriate inspection gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in performing the Adjust Threading and Tapping Tooling Duty .

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

Duty Area: 2. Setup
Duty Title: 2.11 Adjust Threadrolling Attachments

Duty:
Adjust threadrolling setting on a single part.

Performance Standard:
Given an engineering drawing and process plan, set up the threadrolling attachment on a workbench. Using the proper setup procedure for the attachment selected, mount and set depth and location. Verify the blank size according to the process plan. Dry cycle the machine to assure clearances for the attachment. Run sample part to inspect tracking and adjust the attachment to obtain the correct part size and shape.

Accuracy Level:
As specified on engineering drawings and in process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, tooling, and appropriate tool-holders
Measuring Instruments: Inspection gages and micrometers
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Adjust Threadrolling Attachments Duty.

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

Duty Area: 2. Setup
Duty Title: 2.12 Verify Lubricant and Coolant Supply

Duty:
Verify all lubricant and coolant functions.

Performance Standard:
Verify that all lubricant and coolant delivery systems are operating and that lubricants and coolants are flowing to the proper areas.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools, coolant piping, and proper lubricants and coolants
Measuring Instruments: N/A
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Verify Lubricant and Coolant Supply Duty.

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

Duty Area: 2. Setup
Duty Title: 2.13 Verify Cycle Time

Duty:
Confirm final setup and process capabilities and verify cycle time.

Performance Standard:
Operate the machine through 10 cycles and verify part size to engineering drawings and verify that cycle times and operating functions are performing to the capabilities as set forth in the process plan.

Accuracy Level:
Meet part size specifications as given on the engineering drawings and confirm that cycle times are within +/- 2.5 percent of the process plan.

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools
Measuring Instruments: Micrometers, dial verniers, gages, and stop watch
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Verify Cycle Time Duty.

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

Duty Area: 2. Setup
Duty Title: 2.14 Verify Setup and Conduct a First Run of Multiple Parts

Duty:
Verify collet and spindle performance in a sample run. Adjust slides and collets as needed.

Performance Standard:
In a primary run of multiple parts, verify collet and spindle performance. Measure one piece per spindle, verify compliance to engineering drawing specifications, and record results. Correct adjustments as needed to bring parts into specification. Submit parts for quality control approval.

Accuracy Level:
As specified on engineering drawings and in the process plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools
Measuring Instruments: Micrometers, dial verniers, and appropriate gages
Reference: Machinery's Handbook and machine operations manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Verify Setup and Conduct a First Run of Multiple Parts Duty.

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

Appendix A

Screw Machining-Level II Skills Used in Level III Production Duties

The production and quality assurance skills that follow this page are Screw Machining--Level II skills that apply to the machine operator. They are repeated here for those instances where the setup person then operates the machine in a production run.

Duty Area: 3. Production
- 3.1 Production Operation
- 3.2 Production Maintenance
- 3.3 Tooling Maintenance

Duty Area: 4. Quality Control and Inspection
- 4.1 Part Inspection
- 4.2 Inspection: Optical Comparator

Duty Area: 3. Production
Duty Title: 3.1 Production Operation

Duty:
Stock machine and verify collet tension

Performance Standard:
Following the process plan, stock machine, and verify collet tension and material flow. Adjust as needed for a smooth and continuous run.

Accuracy Level:
As specified in process plan.

Assessment Equipment and Material:
Workstation: Screw machine
Material: Material stock as specified in process plan
Tooling: Hand tools
Measuring Instruments: N/A
Reference: Machinery's Handbook and machine operating manual

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Production Operation Duty.

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

Duty Area: 3. Production
Duty Title: 3.2 Production Maintenance

Duty:
During a production run, verify collet and spindle performance, check cams and slides and adjust as necessary. Adjust collet tension if needed.

Performance Standard:
During a production run, verify collet and spindle performance, check cams and slides and adjust as required for a smooth and continuous run.

Accuracy Level:
As specified in process plan and on part dimensions

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in process plan
Tooling: Hand tools
Measuring Instruments: Dial indicator, appropriate inspection tools, and feeler gages
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Production Maintenance Duty.

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

Duty Area: 3. Production
Duty Title: 3.3 Tooling Maintenance

Duty:
Inspect and assess the condition of the tooling. Refurbish the tooling where appropriate. Refer tooling for repair or regrind where appropriate.

Performance Standard:
Grind and sharpen drills, taps, cut-off tools, reamers, form tools, and all other tooling as needed and as authorized. The operator must demonstrate the ability to recognize when a cutter should be referred to a tool and cutter grinder.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: Screw machine
Material: Existing production run
Tooling: Flashlight, mirror, and appropriate hand tools
Measuring Instruments: N/A
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in performing the Tooling Maintenance Duty.

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

Duty Area: 4. Quality Control and Inspection
Duty Title: 4.1 Part Inspection

Duty:
Inspect sample parts using precision measuring instruments. Record part inspection results.

Performance Standard:
Given an inspection plan, inspect sample parts during a production run, following a written inspection plan using precision measuring instruments. Make necessary adjustments to maintain dimensions as specified in the process plan.

Accuracy Level:
As specified on part prints and in inspection plan

Assessment Equipment and Material:
Workstation: Screw machine
Material: As specified in production plan
Tooling: N/A
Measuring Instruments: Precision micrometers, go/no go gages, pull gages, calipers, and dial indicators
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, or other characteristics that will be assessed in performing the Part Inspection Duty.

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

Duty Area: 4. Quality Control and Inspection
Duty Title: 4.2 Inspection: Optical Comparator

Duty:
Set up and perform the inspection of profiles in shadow and/or reflection.

Performance Standard:
Given a finished part, process plan, blueprint, and an optical comparator, inspect a part's profiles. Produce data necessary to describe the compliance of the profiles.

Accuracy Level:
N/A

Assessment Equipment and Material:
Workstation: An optical comparator
Material: A finished part matching the blueprint
Tooling: Tooling appropriate to the presentation of a part on an optical comparator
Measuring Instruments: Precision tools needed to operate the comparator
Reference: Machinery's Handbook

KSAO:

This table represents the kinds of knowledge, skills, abilities, and other characteristics that will be assessed in the performing the Inspection: Optical Comparator Duty.

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

Appendix B

Machining Skills-Level I Knowledge, Skills, Abilities, and Other Characteristics

The following skills are the knowledge, skills, abilities, and other characteristics taken from Machining Skills--Level I and Screw Machining Level--II that will be required in the performance of the Screw Machining Skills--Level III Standard.

KSAO Area: 1. Written and Oral Communications
- 1.1 Reading
- 1.2 Writing
- 1.3 Speaking
- 1.4 Listening

KSAO Area: 2. Mathematics
- 2.1 Arithmetic
- 2.2 Applications of Geometry
- 2.3 Applications of Algebra
- 2.4 Applications of Trigonometry

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

KSAO Area: 4. Engineering Drawings and Sketches
- 4.1 Standard Orthographic Blueprints
- 4.2 GDT Orthographic Blueprints

KSAO Area: 5. Measurements
- 5.1 Basic Measuring Instruments
- 5.2 Precision Measuring Instruments

KSAO Area: 6. Metalworking Theory
- 6.1 Cutting Theory
- 6.2 Material Properties
- 6.3 Lubricants, Cutting Fluids, and Coolants

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	Prepare a process plan.	Read blueprints. Read tool inventory. Read Machinery's handbook.
2. Job execution	Benchwork Layout	Read process plan.
3. Quality and inspection	Part inspection	Read blueprint. Read inspection plan. Read sampling plan. Read charting instructions.
4. Process improvement	Participation in improvement	Read blueprints. Read process plan. Read team documents.
5. Maintenance	Screw machine preventive maintenance Tooling maintenance	Read checklists. Read manuals.

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	Prepare a process plan.	Write instructions on the process plan.
2. Job execution	Benchwork Layout	Write a record of job activities.
3. Quality and inspection	Part inspection	Write a record of inspection activities.
4. Process improvement	Process adjustment	Write a record of adjustment and improvement activities.
5. Maintenance	Screw machine maintenance Tooling maintenance	Write a record of maintenance activities. Complete history forms.
6. Safety and environment	Operations and handling HazMat handling and storage Material storage	Write a record of activities involving the handling and storage of standard and hazardous materials.

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	Prepare a process plan.	Verbally explain the process plan.
2. Job execution	Benchwork Layout Operate screw machines	Explain job execution activities.
3. Quality and inspection	Part inspection	Explain inspection procedures. Explain control charts and their role in process control.
4. Process improvement	Process adjustment Participation in improvement	Propose process remedies. Explain the corrective action.
5. Maintenance	Housekeeping Screw machine maintenance Tooling maintenance	Explain the condition of a screw machine and the maintenance action to be taken.
6. Safety and environment	Operations and handling HazMat handling and storage Material storage	Explain the actions bearing on safe practices.

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	Prepare a process plan.	Listen to verbal instructions.
2. Job execution	Benchwork Layout	Listen to verbal instructions.
3. Quality and inspection	Part inspection	Listen to verbal instructions.
4. Process improvement	Process adjustment	Listen to verbal instructions.
5. Maintenance	Housekeeping Screw machine maintenance Tooling maintenance	Listen to verbal instructions.
6. Safety and environment	Operations and handling HazMat handling and storage	Listen to verbal instructions.

KSAO Area: 2. Mathematics
KSAO: 2.1 Arithmetic

KSAO Definition:

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

Performance Requirement:

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

Duty Standard Cross Reference Table:

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

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Calculate speeds and feeds.
2. Job execution	Benchwork Layout	Calculate necessary dimensions from the blueprint.
3. Quality and inspection	Part inspection	Calculate necessary dimensions from the blueprint. Calculate statistics required by the control chart.

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

KSOA 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 positioning.

Performance Requirement:

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

Duty Standard Cross Reference Table:

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

Duty Area	**Task**	**Activity**
1. Job planning	Prepare process plan.	Apply geometry to select sequence operations.
2. Job execution	Benchwork Layout Operate screw machines	Apply geometry to hold work appropriately. Apply geometry to produce surfaces correctly.
3. Quality and inspection	Part inspection	Apply geometry to locate surfaces and centerlines.

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 Algebra KSAO.

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Use standard formulas customary to the trade.
2. Job execution	Benchwork Layout Operate screw machine.	Use standard formulas customary to the trade.
3. Quality and inspection	Inspection control	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 the unknown 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 Trigonometry KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Use trig-based trade formulas.
2. Job execution	Benchwork Layout Operate screw machine.	Use trig-based trade formulas.
3. Quality and inspection	Inspection control	Use trig-based trade formulas.

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

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

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

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

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Sequence operations.
2. Job execution	Benchwork Layout Operate screw machines	Follow the process plan, deviating according to decision rules where necessary.

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

KSAO Definition:

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

Performance Requirement:

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

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Basic Problem Solving KSAO.

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

KSAO Area: 4. Engineering Drawings and Sketches
KSAO: 4.1 Standard Orthographic Blueprints

KSAO Definition:
Interprets standard orthographic blueprints.

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

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

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Gather the geometric and dimensional data from a blueprint to sequence operations.
2. Job execution	Layout	Gather the geometric and dimensional data from a blueprint to perform a layout.
3. Quality and inspection	Part inspection	Gather the geometric and dimensional data from a blueprint to perform inspection on a finished part.

KSAO Area: 4. Engineering Drawings and Sketches
KSAO: 4.2 GDT Orthographic Blueprints

KSAO Definition:
Interprets GDT orthographic blueprints.

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

Duty Area *Cross Reference Table:*
This table identifies some of the activities that require the GDT Orthographic Blueprints KSAO.

Duty Area	Task	Activity
1. Job planning	Prepare a process plan.	Gather geometric data and dimensional data from a GDT blueprint to sequence operations.
2. Job execution	Benchwork Layout Operate screw machines	Gather geometric and dimensional data from a GDT blueprint to perform a layout.
3. Quality and inspection	Part inspection	Gather geometric and dimensional data from a GDT blueprint to perform inspection of a finished part.

KSAO Area: **5. Measurements**
KSAO: **5.1 Basic Measuring Instruments**

KSAO Definition:

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

Performance Requirement:

Given a blueprint and a finished part from that print, as well as a selection of appropriate basic measuring instruments, determine a part's compliance along 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**
1. Job execution	Benchwork Layout Operate screw machines	Set the length of layout tools using basic instruments.
2. Quality and inspection	Part inspection	Inspect dimensions that call for the use of basic measuring tools on a finished part.

KSAO Area: 5. Measurements
KSAO: 5.2 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 blueprint and a finished part from that print, as well as a selection of appropriate precision tools, determine a part's compliance along 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**
1. Job execution	Benchwork Layout Operate screw machines	Determine the concentricity of a turned part using an indicator.
2. Quality and inspection	Part inspection	Inspect the dimensions of a finished part that calls for the use of precision measuring tools.

KSAO Area: 6. Metalworking Theory
KSAO: 6.1 Cutting Theory

KSAO Definition:
Understands and can explain the ideas 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 blueprint 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 of the activities that require the Cutting Theory KSAO.

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Determine speeds and feeds.
2. Job execution	Benchwork Layout Operate screw machines	Select cutters appropriate to machine operations.

KSAO Area: 6. Metalworking Theory
KSAO: 6.2 Material Properties

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

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

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

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Predict speeds and feeds, as well as tooling requirements based on known properties of a material.
2. Job execution	Benchwork Layout Operate screw machine	Respond to cutting conditions imposed by material properties as experienced in machining the material.

KSAO Area: 6. Metalworking Theory
KSAO: 6.3 Lubricants, Cutting Fluids, and Coolants

KSAO Definition:

Recognizes, selects, and applies appropriate lubricants, cutting fluids, coolants, and coolant delivery systems.

Performance Requirement:

Given a set of screw machine operating conditions, identify the appropriate lubricants, coolants, and delivery system.

Duty Standard Cross Reference Table:

This table identifies some of the activities that require the Lubricants, Cutting Fluids, and Coolants KSAO.

Duty Area	**Task**	**Activity**
1. Job planning	Prepare a process plan.	Select the appropriate lubricants, coolants, and delivery system for a given screw machine operation.
2. Job execution	Operate screw machines	Operate screw machine using the correct lubricants, coolants, and coolant delivery system.

Appendix C
Related Metalworking Standards in This Series

Machining Skills-Level I
Machining Skills-Level II
Machining Skills-Level III
Metalforming Skills-Stamping-Level II
Metalforming Skills-Stamping-Level III
Metalforming Skills-Roll Forming-Level II
Metalforming Skills-Spinning-Level II
Machine Building Skills-Level II
Machine Building Skills-Level III
Press Brake Skills-Level II (Available Spring 1997)
Press Brake Skills-Level III (Available Spring 1997)

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