



Toolkit Roadmap

	<p>Machining Level I Credential Overview</p> <h2>Measurement, Materials, & Safety</h2>	<p>Title of report Credential name</p>
OVERVIEW	<p>This certification validates that an individual has the fundamental knowledge of standard steel classifications and numbering systems, reading of precision measuring devices, shop and machine safety, and general machining practices, and inspection techniques.</p>	<p>Narrative description of credential</p>
COMPETENCIES	KNOWLEDGE + SKILLS	

DEFINITION OF TERMS

Competency, knowledge and skill areas often offer varying definitions. For purposes of this toolkit, NIMS defines them in the following manner:

Competencies	A competency area is a cluster of learned knowledge, skills and abilities to be proficient and effective in a specific job.
Knowledge	A knowledge area represents a theoretical understanding of the subject.
Skills	A skill area is a specific learned ability developed from training and/or experience. A skill is also a subset of a competency.

BENEFITS AND VALUES

This crosswalk connects the dots between education and industry, creating a common language, removing the guesswork from the hiring and upskilling equation. This toolkit was driven by and created for industry, defining and translating NIMS credentials for all users.

Employers can use this toolkit to streamline hiring practices, develop better job postings, and incorporate NIMS credentials into training operations.

Educators can use this crosswalk to design their curriculum, resulting in instructional sessions aligned with industry standards and directly linked to nationally recognized credentials.

Students can use this information to plan their career path by learning which credentials will fit their personal career goals and to better translate their respective skills sets developed in their training program.



CNC Milling: Operations

OVERVIEW

This certification validates that an individual is able to successfully machine parts by operating a computer numerical control (CNC) machine; maintain quality and safety standards; keep records; maintain equipment and supplies; and perform routine preventative maintenance.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPM Calculations SFM to RPM Conversion	Sign Numbers Use of Scientific Calculator
Cutting Tool Assembly	Configuration (LOC and EOH) Fitting (tightening and setting) Holder Applications	Inspection of Cutters Inspection of Holders
Geometrical Dimensioning and Tolerancing	Feature Control Frame Geometric Control Symbols Geometric Tolerancing Categories	Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Flatness Verification Hole Gaging	Perpendicularity Verification Position Verification Profile of a Surface Verification Surface Finish Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Drilling Face Milling Peripheral Milling	Pocket Milling Reaming Tapping
Measurements	Reading Micrometers Reading Steel Rule Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring Fixture Offset Adjustments Geometry Offset Adjustments Machine Controls	Machine Startup and Shutdown Machine Warm Up Part Loading (vise/fixture) Tool Height Offset Adjustments
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions



CNC Milling: Operations

COMPETENCIES

KNOWLEDGE + SKILLS

Shop Safety

Blood Born Pathogen
Fire Prevention/Suppression
Hazardous Material Information System (HMIS)
Lock Out/Tag Out

Personal Protective Equipment (PPE)
Safety Data Sheets (SDS)
Waste Removal



Machining Level I Credential Overview

CNC Milling: Programming Setup & Operations

OVERVIEW

This certification validates that an individual is able to setup and operate a CNC Milling Center; maintain quality and safety standards; keep records; maintain equipment and supplies.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPM Calculations Pythagorean Theorem Right Angle Trigonometry	SFM to RPM Conversion Sign Numbers Use of Scientific Calculator
Cutting Tool Assembly	Configuration (LOC and EOH) Holder Applications Fitting (tightening and setting)	Inspection of Cutters Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturer's Technical Data References
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frame
Inspection	Feature with Size Verification Feature without Size Verification Flatness Verification Hole Gaging	Perpendicularity Verification Position Verification Profile of a Surface Verification Surface Finish Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Drilling Face Milling Peripheral Milling	Pocket Milling Reaming Tapping
Measurements	Reading Micrometers Reading Steel Rule Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring Fixture Offset Adjustments Geometry Offset Adjustments Machine Controls	Machine Startup and shutdown Machine warm up Part Loading (vise/fixture) Tool Height Offset Adjustments



Machining Level I Credential Overview

CNC Milling: Programming Setup & Operations

COMPETENCIES	KNOWLEDGE + SKILLS	
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Programming	Canned Cycles (holes) Cutter Radius Compensation Developing and Interpret Setup Sheets Fixture Offsets Motion Commands	Plotting Coordinates Program Structure and Formats Programming Words (code memory) Rectangular Coordinate System Selecting Program Zero
Setup	Aligning a Vise/Fixture Establish XY Zero from a Hole Establish XY Zero from Two Surfaces	Machine Controls Program Verification (dry run)
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



CNC Turning: Operations

OVERVIEW

This certification validates that an individual is able to successfully machine parts by operating a computer numerical control (CNC) machine; maintain quality and safety standards; keep records; maintain equipment and supplies; and perform routine preventative maintenance.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPM Calculations SFM to RPM Conversion	Sign Numbers Use of Scientific Calculator
Cutting Tool Assembly	Fitting (tightening and setting) Inspection of Cutters	Inspection of Holders
Geometrical Dimensioning and Tolerancing	Feature Control Frame Geometric Control Symbols Geometric Tolerancing Categories	Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Runout Verification	Surface Finish Verification Total Runout Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Facing OD Turning	
Measurements	Reading Micrometers Reading Steel Rules Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring Fixture Offset Adjustments Geometry Offset Adjustments Machine Controls	Machine Startup and Shutdown Machine Warm Up Part Loading (chuck/collet) Workshift Adjustments
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



Machining Level I Credential Overview

CNC Turning: Programming Setup & Operations

OVERVIEW

This certification validates that an individual is able to setup and operate a CNC Turning Center; maintain quality and safety standards; keep records; maintain equipment and supplies.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPR Calculations Pythagorean Theorem Right Angle Trigonometry	SFM to RPM Conversion Sign Numbers Use of Scientific Calculator
Cutting Tool Assembly	Fitting (tightening and setting) Inspection of Cutters	Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturers Technical Data References
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Runout Verification	Surface Finish Verification Total Runout Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Facing OD Turning	
Measurements	Reading Micrometers Reading Steel Rules Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring Fixture Offset Adjustments Geometry Offset Adjustments Machine Controls	Machine Startup and Shutdown Machine Warm Up Part Loading (chuck/collet) Workshift Adjustments
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions



Machining Level I Credential Overview

CNC Turning: Programming Setup & Operations

COMPETENCIES	KNOWLEDGE + SKILLS	
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Programming	Cutter Radius Compensation Developing and Interpret Setup Sheets Fixture Offsets Motion Commands Plotting Coordinates	Program Structure and Formats Programming Words (code memory) Rectangular Coordinate System Selecting Program Zero
Setup	Boring Soft Jaws or Collet Machine Controls Mounting Workholding Devices	Program Verification (dry run) Setting Geometry Offset for Center Cutting Tools Setting XZ Geometry Offsets
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



Drill Press Skills

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, basic drilling applications, machine set ups, operations, inspection techniques and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPR Calculations	SFM to RPM Conversion Use of Scientific Calculator
Cutting Tool Assembly	Fitting (tightening and setting) Inspection of Cutters	Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturers Technical Data References
Inspection	Feature with Size Verification Feature without Size Verification Perpendicularity Verification	Position Verification Surface Finish Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Counterboring Countersinking Drilling	Reaming Tapping
Measurements	Reading Micrometers Reading Steel Rule Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators Use of Micrometers Use of Steel Rules
Operations	Deburring	Part Loading (vise/fixture)
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Setup	Aligning Cutters to Center Punch (crosshatch) Mounting Stops	Moveable Vise-Jaw Adjustment



Drill Press Skills

COMPETENCIES

KNOWLEDGE + SKILLS

Shop Safety

Blood Born Pathogen
Fire Prevention/Suppression
Hazardous Material Information System (HMIS)
Lock Out/Tag Out

Personal Protective Equipment (PPE)
Safety Data Sheets (SDS)
Waste Removal



Grinding Skills

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, basic surface grinding applications, machine set ups, operations, inspection techniques and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic Pythagorean Theorem	Right Angle Trigonometry Use of Scientific Calculator
Cutting Tool Selection	Grinding Wheel Applications Grinding Wheel Features/Attributes	Grinding Wheel Nomenclature
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Angularity Verification Feature with Size Verification Feature without Size Verification Perpendicularity Verification	Position Verification Profile of a Surface Verification Surface Finish Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Side Grinding	Surface Grinding
Measurements	Reading Micrometers Reading Steel Rules Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators Use of Micrometers Use of Steel Rules
Operations	Part Loading (magnetic chuck)	Wheel Dressing
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Setup	Balancing Grinding Wheels Mounting Grinding Wheels	Mounting/Dressing Magnetic Chucks



Grinding Skills

COMPETENCIES

KNOWLEDGE + SKILLS

Shop Safety

Blood Born Pathogen
Fire Prevention/Suppression
Hazardous Material Information System (HMIS)
Lock Out/Tag Out

Personal Protective Equipment (PPE)
Safety Data Sheets (SDS)
Waste Removal



Job Planning, Benchwork & Layout

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, hand operations such as drilling, reaming, and sawing, layout, inspection techniques, and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPM Calculations Pythagorean Theorem Right Angle Trigonometry	SFM to RPM Conversion Taper per Inch/Foot Calculations Use of Scientific Calculator
Assembly	Bushing Installation	Fastener Installation
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturer's Technical Data References
Drilling	Hand Drilling	
Filing	Deburring File Maintenance File Selection	File Types Filing Techniques Flat Filing
Fits	ANSI Standard Fit Symbols	Classes of Fits
Inspection	Feature with Size Verification Feature without Size Verification Hole Gaging	Position Verification Surface Finish Verification Thread Gaging
Layout	Layout Fluid Layout Tools	Scribing Surface/Height Gage (with scriber attachment)
Machine Safety	Machine Guarding	
Material Preparations	Bar Stock Sizes	Cutting Blanks
Measurements	Reading Micrometers Reading Steel Rule Reading Vernier Scales	Use of Calipers Use of Micrometers Use of Steel Rules (scale)
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices



Job Planning, Benchwork & Layout

COMPETENCIES	KNOWLEDGE + SKILLS	
Reaming	Hand Reaming	
Sawing	Hack Saw Procedures	Hack Sawing
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal
Threading	Hand and Power Tapping Thread Classes	Thread Percentages



Manual Milling Skills

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, basic manual milling machining applications, machine set ups, operations, inspection techniques and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPM Calculations (based on given chip load)	SFM to RPM Conversion Use of Scientific Calculator
Cutting Tool Assembly	Configuration (LOC and EOH) Fitting (tightening and setting) Holder Applications	Inspection of Cutters Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturers Technical Data References
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Hole Gaging Parallelism Verification	Perpendicularity Verification Position Verification at MMC Surface Finish Verification Thread Gaging
Machine Maintenance	Coolants Gib Adjustment	Oils and Lubrications Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Drilling Face Milling Peripheral Milling	Plunge Milling (optional) Reaming Slot Milling
Material Preparations	Bar Stock Sizes Cutting Blanks	Deburring
Measurements	Reading Micrometers Reading Steel Rule Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring	Part Loading (vise/fixture)



Machining Level I Credential Overview

Manual Milling Skills

COMPETENCIES	KNOWLEDGE + SKILLS	
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Setup	Aligning a Vise/Fixture Establish XY Zero from a Hole	Establish XY Zero from Two Surfaces Tramming
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



Measurement, Materials, & Safety

OVERVIEW

This certification validates that an individual has the fundamental knowledge of standard steel classifications and numbering systems, reading of precision measuring devices, shop and machine safety, and general machining practices, and inspection techniques.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic Pythagorean Theorem	Right Angle Trigonometry Use of Scientific Calculator
Filing	File Maintenance File Selection	File Types Filing Techniques
Fits	ANSI Standard Fit Symbols	Classes of Fits
Geometrical Dimensioning and Tolerancing	Feature Control Frame Geometric Control Symbols Geometric Tolerancing Categories	Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Gage Block Assembly	Sampling Procedure
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Drilling Pocket Milling	Reaming Tapping
Materials	Standard Steel Classification	Standard Steel Numbering System (AISI/SAE)
Measurements	Reading Micrometers Reading Steel Rule	Reading Vernier Scales
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Means of Egress (Evacuation) Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



Machining Level I Credential Overview

Turning Operations: Turning Between Centers

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, between centers applications, machine set ups, operations, inspection techniques and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPR Calculations	SFM to RPM Conversion Use of Scientific Calculator
Cutting Tool Assembly	Fitting (tightening and setting) Inspection of Cutters	Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturers Technical Data References
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Runout Verification	Surface Finish Verification Thread Gaging Total Runout Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Facing Knurling OD Grooving	OD Threading OD Turning
Material Preparation	Bar Stock Sizes	Sawing Blanks
Measurements	Reading Micrometers Reading Steel Rules Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring	Part Loading (chuck/collet)
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions



Machining Level I Credential Overview

Turning Operations: Turning Between Centers

COMPETENCIES	KNOWLEDGE + SKILLS	
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Setup	Mounting Chucks/Collets Setting Tools (center and diameter)	Tailstock Alignment
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal



Machining Level I Credential Overview

Turning Operations: Turning Chucking Skills

OVERVIEW

This certification validates that an individual has the skills and knowledge to successfully complete process planning, basic chucking applications, machine set ups, operations, inspection techniques and safety standards.

COMPETENCIES

KNOWLEDGE + SKILLS

Applied Mathematics	Arithmetic IPR Calculations	SFM to RPM Conversion Use of Scientific Calculator
Cutting Tool Assembly	Fitting (tightening and setting) Inspection of Cutters	Inspection of Holders
Cutting Tool Selection	Cutter Applications Cutter Features/Attributes	Manufacturers Technical Data References
Geometrical Dimensioning and Tolerancing	Datum Reference Frame (DRF) Degrees of Freedom (DOF) Feature Control Frame Geometric Control Symbols	Geometric Tolerancing Categories Geometric Tolerancing Characteristics Geometric Tolerancing Zone Shapes Symbols Associated with Feature Control Frames
Inspection	Feature with Size Verification Feature without Size Verification Perpendicularity Verification	Surface Finish Verification Thread Gaging Total Runout Verification
Machine Maintenance	Coolants Oils and Lubrications	Refractometer Readings
Machine Safety	Machine Guarding	
Machining Applications	Boring Drilling Facing ID Grooving	ID Threading OD Grooving OD Threading OD Turning
Material Preparation	Bar Stock Sizes	Sawing Blanks
Measurements	Reading Micrometers Reading Steel Rules Reading Vernier Scales Use of Calipers	Use of Dial Indicators Use of Drop Indicators (travel dial) Use of Micrometers Use of Steel Rules
Operations	Deburring	Part Loading (chuck/collet)
Print Reading	Block Tolerances Line Types and Conventions Orthographic Projection	Surface Finish Requirements Title Blocks and Revisions



Machining Level I Credential Overview

Turning Operations: Turning Chucking Skills

COMPETENCIES	KNOWLEDGE + SKILLS	
Process Planning	Machine Configuration Machine Selection	Operation Sequencing Workholding Concepts/Devices
Setup	Boring Soft Jaws/Collets Mounting Chucks/Collets	Setting Tools (center and diameter) Tailstock Alignment
Shop Safety	Blood Born Pathogen Fire Prevention/Suppression Hazardous Material Information System (HMIS) Lock Out/Tag Out	Personal Protective Equipment (PPE) Safety Data Sheets (SDS) Waste Removal