2026 PRECISION MACHINING

Program Standards

CONTENT STANDARD 1.0: PROFESSIONAL ORGANIZATIONS AND LEADERSHIP

Performance Standard 1.1: Student Leadership in Career Technical Student Organizations (CTSO) and Professional Associations

1.1.1 Explore the role of professional organizations and/or associations in the Precision Machining Industry.
1.1.2 Define the values, roles, and opportunities provided through career technical student organizations.
1.1.3 Engage in career exploration and leadership development.

Performance Standard 1.2: Career Exploration

1.2.1 Describe mindsets and traits that are most important for career success in the precision machining industry (e.g., attention to detail, troubleshooting).
1.2.2 Identify local and national career opportunities in precision machining.
1.2.3 Describe education and certification or training requirements related to career pathways in the precision machining industry.

CONTENT STANDARD 2.0: FUNDAMENTAL MACHINING SKILLS

Performance Standard 2.1: Safety

2.1.1 Complete a safety test on general shop safety rules and procedures.
2.1.2 Describe the role of the Occupational Safety and Health Administration (OSHA) in regard to workplace safety and incidents.
2.1.3 Describe requirements for personal protection equipment (PPE), to include safety glasses, ear protection, gloves, and clothing in the workplace.
2.1.4 Describe safety guidelines for using any machining tool or piece of equipment.
2.1.5 Identify marked safety areas, related signage and their meanings.
2.1.6 Identify the location and the types of fire extinguishers and other fire safety equipment.
2.1.7 Describe procedures for using fire extinguishers and other fire safety equipment.
2.1.8 Identify the location of and the procedures for using eye-wash stations.
2.1.9 Describe the requirements for and location of the posted evacuation routes.
2.1.10 Describe general electrical safety.
2.1.11 Describe lockout/tagout (LOTO) procedures and rationale.
2.1.12 Identify the location of safety data sheets (SDS), describing the information they contain.
2.1.13 Maintain clean and orderly work areas.
2.1.14 Dispose of scrap metal chips, shavings, oil, and coolant.

Performance Standard 2.2: Blueprint Reading

2.2.1 Interpret line types, title blocks, orthographic projections, and revision control.
2.2.2 Sketch a part.
2.2.3 Interpret blueprints, including geometric dimensioning and tolerancing (i.e., GD&T basics).

Performance Standard 2.3: Planning

2.3.1 Access reference information used in performing machining work.
2.3.2 Describe the significance of following an order of operations.
2.3.3 Select machines and tooling, based on work orders.

Performance Standard 2.4: Machine and Tool Maintenance

2.4.1 Lubricate equipment parts, as needed.
2.4.2 Clean and store hand tools, cutters, fixtures, jigs, and attachments.
2.4.3 Inspect hand tools for defects, verifying safe use.

2.4.4 Inspect equipment for safe operational conditions.

CONTENT STANDARD 3.0: BENCHWORK SKILLS

Performance Standard 3.1: Hand Tools

3.1.1 Describe safety precautions and procedures for using tools.
3.1.2 Select hammer types by operation.
3.1.3 Select punches, stamps, and chisels, by operation.
3.1.4 Select assembly tools (e.g., allen wrenches, screwdrivers, wrenches) for assembly operations.
3.1.5 Describe the applications for saw blades with different ratios of tooth pitch.
3.1.6 Saw materials by hand with a hacksaw.
3.1.7 Describe the use of the three taps used for threading a blind hole.
3.1.8 Cut internal and external threads with a tap or die.
3.1.9 Describe the use of helicoil and thread inserts.
3.1.10 Ream holes, using adjustable and non-adjustable reamers.
3.1.11 Describe drill sizes as they relate to the various sizes of reamers.
3.1.12 Describe the purpose of easy outs and tap extractors.
3.1.13 Remove damaged screws.
3.1.14 Describe procedures for cutting splines and keyways, using broaches, bushings, shims and arbor presses.
3.1.15 Press bushings, pins, and bearings, using an arbor press.
3.1.16 Select deburring tool by operation.
3.1.17 Deburr workpieces to required tolerances.

CONTENT STANDARD 4.0: POWER SAWS

Performance Standard 4.1: Power Saw Setup

4.1.1 Describe safety precautions for using power saws.
4.1.2 Select the power saw (e.g., horizontal bandsaw, vertical bandsaw, cold saw) based on the cutting operation.
4.1.3 Select power saw blade based on the material and cutting operation.
4.1.4 Select the cutting speed for specific material.
4.1.5 Replace blades in power saws.

Performance Standard 4.2: Power Saw Operation

4.2.1 Measure material to be cut.
4.2.2 Cut materials to layout specifications.
4.2.3 Describe the procedures for cutting and welding (i.e., cut to length, anneal after welding, grind) a band saw blade.

CONTENT STANDARD 5.0: DRILL PRESSES

Performance Standard 5.1: Drill Press Setup

5.1.1 Describe safety precautions for using drill presses.
5.1.2 Identify types of drill presses.
5.1.3 Identify the components of drill presses.
5.1.4 Adjust the table height based on workpiece and operation.
5.1.5 Calculate the RPM (Revolutions Per Minute) for various sizes of drills and materials.
5.1.6 Select the RPM settings and feed settings, based on materials and operation.
5.1.7 Describe procedures for using the drill chuck and Morse tapered spindle.
5.1.8 Describe procedures for using drill press work-holding devices.

Performance Standard 5.2: Drill Press Operation

5.2.1 Center drill a workpiece.
5.2.2 Drill a workpiece.
5.2.3 Ream a hole in a workpiece.
5.2.4 Counterbore a workpiece.
5.2.5 Spot face a workpiece.

5.2.6 Countersink a hole in a workpiece.
5.2.7 Hand tap a hole in workpiece.

CONTENT STANDARD 6.0: PEDESTAL GRINDERS AND HAND SHARPENING CUTTING TOOLS

Performance Standard 6.1: Pedestal Grinder Setup

6.1.1 Describe safety precautions and guards used with pedestal grinders.
6.1.2 Identify major parts of the pedestal grinder and their functions.
6.1.3 Select wheel type based on grinding operation.
6.1.4 Determine if a wheel is cracked before mounting.
6.1.5 Identify blotters on the wheel and the information they contain.
6.1.6 Describe safety precautions and clearances (i.e., rake, relief, radius) used when sharpening cutting tools.

Performance Standard 6.2: Pedestal Grinder and Cutting Tools Sharpening

6.2.1 Mount grinding wheels.
6.2.2 Set up tool rests.
6.2.3 Select wheel, based on material being grinded.
6.2.4 Dress grinding wheels.
6.2.5 Grind high-speed tool bits.
6.2.6 Grind brazed-carbide tool bits.
6.2.7 Grind drill bits.

CONTENT STANDARD 7.0: LATHES

Performance Standard 7.1: Lathe Setup

7.1.1 Describe safety precautions for using lathes.
7.1.2 Identify the parts of the lathe.
7.1.3 Set up an engine lathe.
7.1.4 Secure tools, tool holders, and fixtures or attachments.
7.1.5 Select and set feeds and speeds, based on materials and operation.

Performance Standard 7.2: Lathe Operation

7.2.1 Set up lathes.
7.2.2 Align lathe centers, using methods (e.g., point-to-point, center ground bar) to ensure accuracy.
7.2.3 Turn and face workpieces held in chucks.
7.2.4 Rough cut and finish cut with lathes.
7.2.5 Deburr workpieces on a lathe.
7.2.6 Perform hole-making operations (e.g., drilling, countersinking, reaming, tapping, counterboring).
7.2.7 Bore holes with lathes.
7.2.8 Knurl parts with lathes.
7.2.9 Cut external and internal threads with lathes.
7.2.10 Chase threads with lathes.
7.2.11 Describe procedures for taper turning with taper attachments.
7.2.12 Describe procedures for taper turning with compound rest.
7.2.13 Describe procedures for performing contour, angular, or radius cuts with lathes.
7.2.14 Describe the procedures for using follower and steady-rests.
7.2.15 Describe procedures for setting up face plates and lathe dogs.

CONTENT STANDARD 8.0: MILLING MACHINES

Performance Standard 8.1: Milling Machine Setup

8.1.1 Describe safety precautions for using milling machines.
8.1.2 Identify the parts of the horizontal and vertical milling machines and their functions.
8.1.3 Lubricate milling machines.
8.1.4 Tram the head.
8.1.5 Align fixtures/vises.

Performance Standard 8.2: Milling Machine Operation

8.2.1 Locate the workpiece edge, using an edge finder and reference coordinates along the X, Y, and Z axes relative to the defined datum.
8.2.2 Locate an existing hole, using an indicator.
8.2.3 Set feeds and speeds for milling work, based on materials and operation.
8.2.4 Square up workpieces.
8.2.5 Perform end milling on a workpiece.
8.2.6 Perform facing operations on a workpiece.
8.2.7 Drill holes with a milling machine.
8.2.8 Perform reaming operations on a workpiece.
8.2.9 Cut external keyways on a workpiece.
8.2.10 Bore holes with milling machines.
8.2.11 Perform form milling on a workpiece, using tools (e.g., slitting saws, key cutters, dovetails, corner-rounders, chamfers).
8.2.12 Perform indexing operations on a workpiece, using a dividing head.
8.2.13 Set up and operate rotary tables.

CONTENT STANDARD 9.0: INSPECTION AND PRECISION MEASURING

Performance Standard 9.1: Gages, Scales, and Tools

9.1.1 Select the inspection gages and tools based on inspection operation.
9.1.2 Identify steel rules and calipers and when they are used.
9.1.3 Identify micrometers and when they are used.
9.1.4 Identify Vernier tools and when they are used.
9.1.5 Identify dial indicators and when they are used.
9.1.6 Identify a surface plate and when it is used.
9.1.7 Identify go/no-go gages and when they are used.
9.1.8 Identify the following gages and their uses: radius, thread-pitch, angle, thread, pin, ring.
9.1.9 Identify surface finishes, tolerances, and measuring procedures for surface finish inspection.
9.1.10 Validate calibration of gages and tools against a standard.
9.1.11 Measure accurately, using inspection gages and tools.
9.1.12 Document results of inspection.

CONTENT STANDARD 10.0: CNC (COMPUTER NUMERICAL CONTROL) INTRODUCTION

Performance Standard 10.1: Machines, Components, and Control Functions Orientation

10.1.1 Describe machine orientation and functions of CNC machines.
10.1.2 Describe CNC machine tools and components.
10.1.3 Describe control functions (e.g., tool offsets, part offsets).

Performance Standard 10.2: Operations and Processes

10.2.1 Describe precautions for CNC machine and tool use safety (e.g., compressed air, coolant management).
10.2.2 Describe the procedures for machine startup.
10.2.3 Describe the procedures for loading and unloading parts.
10.2.4 Describe the procedures used to run a simple program using G-code.
10.2.5 Describe the procedures for conducting in-process inspection.

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