

CNC MILLING & TURNING BLUEPRINT

This Blueprint contains the subject matter content of this Skill Connect Assessment. This Blueprint does **NOT** contain the information one would need to fully prepare for a SkillsUSA Championships contest. Please refer to the *SkillsUSA Championships Technical Standards* CD-ROM for the current year or purchase and download the relevant "Contest Singles." Both are available through www.skillsusa.org > Shop > Educational Materials Catalog.

Standards and Competencies

Apply basic machining skills per industry standards

- Demonstrate the basic math skills essential to CNC machining
- Identify and utilize measuring tools that are basic to CNC machining
- Interpret and apply information from prints and drawings
- Measure part to nearest +/- .001"
- Demonstrate safe working practices on machines
- Use various precision measuring tools (i.e., micrometers, calipers, radius gages)
- Use correct filing techniques and appropriate terminology
- Define and calculate speed and feed rates (SFPM, CCS, IPM, IPR)
- Demonstrate knowledge of cutting tools, clamping devices and materials
- Perform mathematical calculations that enable the solving of complex trigonometric, geometric and algebraic problems applicable to CNC machining processes

Demonstrate knowledge of CNC programming per industry standards

- Manually write and verify the CNC program without the use of CAM software according to print specifications, dimensions and tolerances (competitor has the opportunity to edit any program errors on the machine)
- Display complete knowledge of DIN/ISO Programming (G and M codes)
- Apply the correct use of cutter compensation (G41/G42)
- Demonstrate knowledge of incremental and absolute positioning
- Demonstrate knowledge of coordinate system
- Determine proper machining sequences from work piece drawing
- Adjust speeds and feed as needed

Set up a CNC machine per industry standards

- Set up machine and establish work piece zero reference point for machining the part
- Select and mount necessary tools from the provided tool list
- Establish tool length offsets and enter them into the CNC machine control
- Enter any necessary tool corrections (i.e., cutter radius compensations) into the CNC machine control
- Identify mill and lathe fixtures

Perform mathematical calculations as needed for calculating speeds, feeds, program coordinates, angles, radii and tangent points

- Calculate CNC speeds and feeds
- Calculate programming coordinates from the drawing
- Calculate angles, radii and tangent points

Communicate and demonstrate an understanding of all symbols on a blueprint

- Read and interpret technical blueprints
- Understand all symbols on technical blueprints, such as geometric tolerances, surface-finish symbols, corner-break symbols, etc.

Inspect work per industry standards

- Visually inspect for conformity to print (shape and features of part to drawing)
- Inspect for broken edges
- Inspect for damage to part (clamp marks, scratches)
- Inspect part for dimensional accuracy

Committee Identified Academic Skills

The SkillsUSA national technical committee has identified that the following academic skills are embedded in the CNC milling training program and assessment:

Math Skills

- Use fractions to solve practical problems
- Simplify numerical expressions
- Measure angles
- Apply transformations (rotate or turn, reflect or flip, translate or slide and dilate or scale) to geometric figures
- Apply Pythagorean Theorem
- Solve problems using proportions, formulas, and functions
- Solve problems using trigonometry
- Solve problems using Cartesian Coordinate System

Science Skills

- Use knowledge of speed, velocity and acceleration

Language Arts Skills

None Identified

Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Problem solving
- Reasoning and proof
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. To view high school standards, visit: standards.nctm.org/document/chapter7/index.htm. Select “Standards” from menu.

Science Standards

- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics)
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes
- Students conduct research on issues and interests by generating ideas and questions and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.readwritethink.org/standards/index.html.