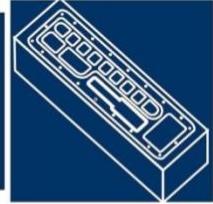


AUTOMATED MANUFACTURING TECHNOLOGY



SkillsUSA Championships Technical Standards

PURPOSE

To evaluate each competitor's preparation for employment in automated manufacturing and the team approach to problem-solving in a work environment. To recognize outstanding students for excellence and professionalism in the field of automated manufacturing technology.

CLOTHING REQUIREMENT

Class C: Competition Specific — Manufacturing/Construction Khaki Attire

- Official SkillsUSA khaki short-sleeve work shirt
- Khaki pants
- Black, brown, or tan work shoes

Note: Safety glasses must have side shields or goggles. (Prescription glasses may be used only if they are equipped with side shields. If not, they must be covered with goggles.)

These regulations refer to clothing items that are pictured and described at www.skillsusastore.org. If you have questions about clothing or other logo items, call 1-888-501-2183.

Note: Competitors must wear their official competition clothing to the competition orientation meeting.

ELIGIBILITY (TEAM OF THREE)

Open to a team of three (3) active SkillsUSA members enrolled in programs with precision machining, automated manufacturing, or CAD/CAM or CNC as an occupational objective. Each state may send one high school and one college/postsecondary team.

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
 - a. CNC machining center with:
 - 1). Machinist vise
 - 2). Hold-downs and clamps
 - 3). Tool holders
 - 4). End mills
 - b. Part(s) design
 - c. Competition packet
 - d. Pencils
 - e. Material for machining
2. Supplied by the competitors:
 - a. All competitors must create a one-page resume. See “Resume Requirement” below for guidelines.
 - b. Three (3) computers:
 - 1). One computer loaded with CAD software for the CAD program
 - 2). One computer loaded with software for the CAM program.
 - 3). One computer to connect to the CNC machine. This computer *must* have an open LAN Port (Ethernet connection) (Must have administrator privilege to the computer to configure the address of the LAN Port.)

Note: Computers must be preloaded with the fully licensed CAD, CAM and CNC Motion software and competitors must have administrative rights to the computers to implement changes if required. No Internet access is allowed during the competition. All software should be pre-installed and tested prior to arriving at the competition to ensure the system will run offline.*
 - c. One 6" dial or digital vernier caliper
 - d. One dial indicator. Dial indicator must have a $\frac{3}{8}$ " holding shank to fit into the tool holder supplied by the technical committee.
 - e. One calculator
 - f. One pair of $\frac{3}{4}$ " and/or 1" parallels (complete set soft-jaw parallel pliers)
 - g. One soft-face hammer
 - h. One 6" or 12" steel rule
 - i. Safety glasses with clear lenses
 - j. Each team must provide two (2) USB memory devices for submitting work to judges
 - k. Each team must provide a machinist handbook
 - l. 6' multiple-outlet power strip
 - m. Each team is allowed to bring their own appropriately sized end mills

Flutes	Fractions	MSC number	Cutting Diameter	Shaft Diameter	Cutting Length
2	3/8" end mill	01710243	3/8"	3/8"	0.5625"
2	1/4" end mill	01710169	1/4"	3/8"	0.5"
2	1/4" end mill	01748011	1/4"	3/8"	1"
2	1/8" end mill	01710086	1/8"	3/8"	0.375"
2	1/8" ball mill	01760081	1/8"	3/8"	0.375"
	90-Degree Conical	00199364		1/4"	
	60-Degree Conical	01787084		1/8"	

Note: Only the above listed items will be allowed in the competition area during the competition.
 *No Internet access is permissible during the competition. If software is not installed or operating, and students are required to connect to the Internet, a 25-point penalty will be assessed.

If it is confirmed that the competitor/team used the Internet during the competition without the knowledge and permission of the technical committee, the technical committee can assess a penalty of 100 points.

TEAM INDEPENDENCE

Teams are not permitted to communicate with anyone outside of the competition for the duration of the event. Any team observed communicating with advisors, friends, or anyone not part of their team that may be assisting or guiding them is subject to disqualification. Teams may consult with the technical committee if any issues arise, and the committee will decide how to help or guide the team if any action is deemed necessary.

RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA South Carolina competitors should submit their resume by the deadline published on the competition updates page of our website. Failure to submit a resume will result in a 10-point penalty.

Your resume must be saved as a PDF file type using file name format of “Last Name_First Name.” For example, “Amanda Smith” would save her resume as **Smith_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](#) for more information.

Note: Check the Competition Guidelines and/or the updates page on the state website.

PROHIBITED DEVICES

Cellphones, electronic watches and/or other electronic devices not approved by a competition’s national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

Penalties for Prohibited Devices

If a competitor’s electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the Director of the SkillsUSA Championships. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor’s scores may be removed.

SCOPE OF THE COMPETITION

The competition will test the ability to perform, exhibit, and compile skills and knowledge from the following list of competencies determined by the SkillsUSA Automated Manufacturing Technology technical committee. Committee membership includes Intelitek Inc., MasterCam/CNC Software, AutoDesk, CG Tech, Verisurf, and Learning Labs Inc.

KNOWLEDGE PERFORMANCE

The competition includes a written math test assessing general knowledge related to automated manufacturing technology. Written portions may also exist during the skills portion of the competition. The exam is an evaluation that measures ability to produce various solutions to the process that is involved in quoting a job in a rapid prototyping environment.

SKILL PERFORMANCE

The competition includes a team skill performance for three students and evaluates teams for employment in integrated manufacturing technology fields of computer-aided drafting/design (CAD), computer-aided manufacturing (CAM), and computer numerical controlled machining (CNC).

COMPETITION GUIDELINES

1. On Tuesday, all teams assemble for a mandatory orientation at a time and place communicated in the official competition schedule. The national competition runs on Tuesday, Wednesday, and Thursday. The teams will compete on their scheduled day. Teams must bring their computers and above-listed equipment on Tuesday. Tampering with or

removing *any* of the equipment provided during the days of the competition is grounds for disqualification.

2. The national competition runs on Tuesday, Wednesday and Thursday.
 - a. Tuesday: A random placement drawing will determine each team's assigned competition day. Teams will be allotted a time for setup and practice (advisors may attend). All teams must report to the location published in the conference schedule on Tuesday, bring their computers and above-listed equipment, and leave their equipment in the competition area until the end of the day on Thursday.
 - b. Wednesday and Thursday: Teams compete as assigned on their scheduled day.
Note: Tampering with or removing any of the equipment provided during the days of the competition is grounds for disqualification.
3. All team members and advisors are required to attend a debriefing session on Friday morning.
4. Teams must be comprised of three members.
5. The teams will be presented with dimensioned drawing(s) of a part(s) to prototype during the competition.
6. The CAD operators construct the part geometry, the CAM operator generates the tool paths, and the CNC operator sets up and machines the part. When a team member has spare time, he or she will help others in the group.
7. One person should not dominate a team by doing the CAD drawing, the CAM toolpath, and running the CNC machine while using the other members simply as support. The competition is designed to promote creativity in the organization of production responsibility.
8. All group members are responsible for double-checking each other's work and quality control.
9. When the teams finish machining the prototype part(s), they will present it to the client (judges). At this time, the teams will be presented with a second drawing(s) as either a change order or as an additional part(s).
10. Each team will be issued a competition guideline packet. Included in the packet will be all the necessary information and forms to complete the project. These forms will not be highly specific but will coach the teams.
11. All packets, forms, and drawings must be turned in to the judges at the end of the competition.

STANDARDS AND COMPETENCIES

MFG 1.0 — Perform mathematical and measurement calculations used in automated manufacturing situations

- 1.1. Measure work pieces to the nearest.001 inch
- 1.2. Calculate CNC speed and feeds
- 1.3. Calculate stock utilization and setup
- 1.4. Calculate tolerances
- 1.5. Calculate various variables to estimate costs and material usage written evaluation

MFG 2.0 — Design, sketch and plan machine work to U.S. National CAD Standards

- 2.1. Transfer information from provided drawing to CAD drawing
- 2.2. Create CAD file for manufacturing using standard CAD terminology and standard practice
- 2.3. Initiate manufacturing documentation process
- 2.4. Generate a process plan
- 2.5. Plot a CAD file
- 2.6. Export a CAD file
- 2.7. Process Engineering Change Orders (ECO)
- 2.8. Repeat steps as necessary to accommodate ECO

MFG 3.0 — Create a toolpath (CAM file) and the CNC code to related duty tasks of the National Institute for Metalworking Skills (NIMS) Duties and Standards for Machining Skills, Level I

- 3.1. Create process plan (job plan)
- 3.2. Read-in CAD export file
- 3.3. Create toolpath
- 3.4. Verify toolpath
- 3.5. Create CNC code
- 3.6. Send CNC code to machine tool
- 3.7. Process Engineering Change Orders (ECO)
- 3.8. Repeat steps as necessary to accommodate ECO

MFG 4.0 — Perform CNC machining functions given a scenario to the related duty tasks of the National Institute for Metalworking Skills (NIMS) Duties and Standards for Machining Skills, Level I

- 4.1. Verify CNC file existence
- 4.2. Verify toolpath
- 4.3. Set up fixture(s) and tooling on machine
- 4.4. Set up part(s) on mill
- 4.5. Set all offsets and tooling
- 4.6. Adjust machine speeds and feeds as needed
- 4.7. Complete an in-process quality assurance process
- 4.8. Perform tool changes
- 4.9. Perform multiple machining operations in one setup
- 4.10. Demonstrate proficiency in using a CNC machine tool and produce part(s)
- 4.11. Use Total Quality Management practices to verify process and part
- 4.12. Process Engineering Change Orders (ECO)
- 4.13. Repeat steps as necessary to accommodate ECO

MFG 5.0 — Perform and inspect part(s) using a Total Quality Management process

- 5.1. Verify part(s) to provided standards
- 5.2. Verify part(s) to ECO standards
- 5.3. Document process of verification and inspection

MFG 6.0 — Demonstrate safety practices in a working situation to the related duty tasks of the National Institute for Metalworking Skills (NIMS) Duties and Standards for Machining Skills-Level I

- 6.1. Carry out assigned responsibilities while adhering to safe practices in accordance with OSHA requirements and guidelines
- 6.2. Document safety activities as required
- 6.3. Demonstrate safety procedures in running and programming a CNC machine tool

MFG 7.0 — Provide an accurate quotation given an automated manufacturing technology simulated scenario

- 7.1. Solve various solutions to the process that are involved in quoting a job in a rapid prototyping environment

MFG 8.0 — SkillsUSA Framework

The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these Essential Elements. Please reference the graphic, as you may be scored on specific elements applied to your project. For more, visit: www.skillsusa.org/who-we-are/skillsusa-framework/.



COMMITTEE IDENTIFIED ACADEMIC SKILLS

The technical committee has identified that the following academic skills are embedded in this competition.

Math Skills

- Use fractions to solve practical problems.
- Use proportions and ratios to solve practical problems.
- Use scientific notation.
- Solve single variable algebraic expressions.
- Solve multiple variable algebraic expressions.
- Measure angles.
- Find surface area and perimeter of two-dimensional objects.
- Find volume and surface area of three-dimensional objects.
- Construct three-dimensional models.
- Apply Pythagorean Theorem.
- Solve problems using proportions, formulas and functions.
- Find the slope of a line.
- Solve practical problems involving complementary, supplementary and congruent angles.
- Solve problems involving symmetry and transformation.

Science Skills

- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color).

Language Arts Skills

- Provide information in conversations and in group discussions.
- Demonstrate comprehension of a variety of informational texts.
- Organize and synthesize information for use in written and oral presentations.
- Demonstrate knowledge of appropriate reference materials.

CONNECTIONS TO NATIONAL STANDARDS

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

Math Standards

- Numbers and operations
- Geometry
- Measurement
- Data Analysis and probability
- Problem solving
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. For more information, visit: www.nctm.org.

Science Standards

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: <http://www2.mcrel.org/compendium/>.

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 apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique, and discuss print and nonprint texts.
- 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 participate as knowledgeable, reflective, creative and critical members of a variety of literacy communities.
- 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.ncte.org/standards.