



TECHNICAL DRAFTING

SkillsUSA Championships Technical Standards



PURPOSE

To evaluate each competitor's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of technical drafting.

First, download and review the General Regulations at updates.skillsusa.org.

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with technical drafting as an occupational objective. Each state may send one high school and one college/postsecondary competitor.

CLOTHING REQUIREMENTS

Class E: Competition Specific — Business Casual

- Official SkillsUSA white polo shirt
- Black dress slacks or black dress skirt (knee-length minimum)
- Black closed-toe dress shoes

Note: Wearing socks or hose is not required. If worn, socks must be black dress socks and hose must be either black or skin-tone and seamless/nonpattern.

These regulations refer to SkillsUSA Championships Clothing Classifications that are pictured and described at skillsusastore.org. If you have questions about competition uniforms, call the SkillsUSA Store at 888-501-2183.

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

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee for each competitor:
 - a. Flat table space approximately 18" by 36" and a chair
 - b. Access to power
2. Supplied by the competitor:
 - a. A personal computer (laptop preferred) with computer aided drafting and design software. Competitors should ensure that software licensing will work without an internet connection in the competition space outside of the competitor's school's location and outside of the competitor's school's normal calendar year. All competitors must bring their own computer. SkillsUSA is not responsible for computers, or any property left overnight in the competition space.
 - b. Computer aided drafting and design software of choice
 - c. Battery-powered scientific calculator (not a cell phone)
 - d. Mechanical pencil with lead
 - e. *Machinery's Handbook* and a maximum of four (4) additional published reference books.
 - f. One 6' multiple-outlet surge protector
 - g. A flash drive (USB file storage required for submitting drawings as PDF files)
 - h. All competitors must create and submit online a one-page single sided resume. See "Online Submission Requirements" below for guidelines.

Note: All national competitors must also check for competition-specific updates and/or competitor preparation instructions on the SkillsUSA website at updates.skillsusa.org.

Note: Internet access is prohibited during the competition. If software is not installed or operating, competitors may request to connect to the internet, and a 25-point penalty will be assessed. If it is confirmed that the competitor 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.

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.

ONLINE SUBMISSION REQUIREMENTS

All SkillsUSA national competitors must submit their one-page single sided resume online. The deadline and link for online submissions will be published on updates.skillsusa.org.

Failure to submit any of the required document(s) listed below by the established deadline will result in a 10-point penalty.

1. One-page single sided resume

Your submission must be saved as PDF file type using the file name format of “Your Last Name_Your First Name_Resume.” For example, “Amanda Smith” would save the individual PDF submissions file as:

- Smith_Amanda_Resume

SCOPE OF THE COMPETITION

The competition will focus on the application of appropriate entry-level technical drafting skills to solve visualization and presentation problems of a mechanical nature.

KNOWLEDGE PERFORMANCE

The competition will include a test on technical drafting general knowledge. Competitors are also required to take the SkillsUSA Professional Development Test.

SKILL PERFORMANCE

The competitors are assessed on their ability to create 3D models and extract properly scaled 2D views from those models for placement and annotation on standard inch or metric sized drawing sheets.

COMPETITION GUIDELINES

1. The competitors are required to create part and assembly drawings of a mechanical product using computer aided drafting and design software of their choice.
2. The number of required drawings will vary depending on the assigned mechanical product. Project files/prototype of the mechanical product along with details for submission criteria will be provided to the competitors.
Note: Project files/prototype and submission criteria will not be provided until competition time.
3. Competitors will be responsible for creating an assembly drawing complete with appropriate views, balloons, and Bill of Materials. Multiple detail drawings will be required to accompany the assembly drawing.
4. Detail drawings will require appropriate orthographic views, annotations, notes, and tolerances in accordance with ANSI and ASME standards. Knowledge of GD&T is encouraged.
5. Competitors must work independently. No assistance may be given by other competitors, instructors, advisors, or observers.

6. Competitors will submit drawings as PDF files on a USB flash drive. Competitors will not be required to make any hard copy prints.
7. The competitor's number must be on the outside of the USB flash drive, securely attached and clearly visible.
8. Competitors' submissions are judged relative to the technical committee's established criteria for each drawing in their drawing portfolio.

STANDARDS AND COMPETENCIES

TD 1.0 — Create 3D computer models of mechanical parts

- 1.1. Use sketches, solids and Boolean operations of union, subtraction and intersection to build model geometry
- 1.2. Use sketches and paths to create lofted and helical features
- 1.3. Add draft to models
- 1.4. Add threads, fillets, rounds and chamfers to models
- 1.5. Use mass properties commands to determine part weight, mass, center-of-gravity, etc.

TD 2.0 — Build assemblies using 3D computer models

- 2.1. Use assembly constraints to position and relate constructed models to each other
- 2.2. Create an exploded assembly

TD 3.0 — Demonstrate knowledge of drawing borders and title blocks as referenced in ASME Y14.1 Drawing Sheet Size and Format standards, ASME Y14-100 Engineering Drawing Practices.

- 3.1. Recall and create inch and metric sized borders and title blocks

TD 4.0 — Demonstrate knowledge of different drawing types as referenced in ASME Y14.24 Types and Application of Engineering Drawings and ASME Y14.8 Castings, Forgings and Molded Part Drawings standards.

- 4.1. Describe and create 2D mono detail, inseparable assembly and final assembly drawings
 - 4.1.1. Add parts lists and item balloons to inseparable assembly and final assembly drawings
- 4.2. Add symbols and notes associated with castings, forgings and molded parts

TD 5.0 — Demonstrate knowledge of the alphabet of lines and lettering as referenced in ASME Y14.2 Line Conventions and Lettering.

- 5.1. Recognize the different types of lines used on drawings
- 5.2. Recall letter heights used on different areas of a drawing

TD 6.0 — Extract 2D orthographic and pictorial views from 3D computer models to create 2D drawings as referenced in ASME Y14.3 Orthographic and Pictorial Views standard.

- 6.1. Recognize the differences between first angle, third angle and arrow methods of projection
- 6.2. Lay out orthographic views using the third angle projection method
- 6.3. Project true size and shape auxiliary views from inclined surfaces shown in principle orthographic views

TD 7.0 — Demonstrate knowledge of section views as referenced in ASME Y14.3 Orthographic and Pictorial Views standard.

- 7.1. Describe and create full, half and broken-out sections

TD 8.0 — Demonstrate knowledge of datum features as referenced in ASME Y14.5 Dimensioning and Tolerancing standard.

- 8.1. Apply surface and size feature datums
- 8.2. Apply datum targets

TD 9.0 — Apply general and geometric dimensions and tolerances to 2D part views as referenced in ASME B4.1 Preferred Limits and Fits for Cylindrical Parts and ASME Y14.5 Dimensioning and Tolerancing standards

- 9.1. Recognize and calculate size tolerances for clearance and interference fits
- 9.2. Recognize and apply limit, bilateral, unilateral, and unequal bilateral tolerances
- 9.3. Recognize and apply general and geometric dimensioning symbols

TD 10.0 — Demonstrate knowledge of drawing revisions as referenced in ASME Y14.35 Drawing Revisions standard

- 10.1. Create an appropriate revision block
- 10.2. Apply revision balloons
- 10.3. Create a document change notice (DCN)

TD 11.0 — Demonstrate knowledge of threaded fastener notation as referenced in ASME Y14.6 Screw Thread Representation standard.

- 11.1. Recognize and apply inch and metric thread notes

TD 12.0 — Demonstrate knowledge of surface texture notation as referenced in ASME Y14.36 Surface Texture Symbols standard.

- 12.1. Recognize and apply roughness averages, cutoff values and lay symbols to surface texture symbols

TD 13.0 — Demonstrate knowledge of weld notation as referenced in AWS A02.4 Standard Symbols for Welding standard.

- 13.1. Recognize and apply weld type symbols, weld size and weld process abbreviations to basic weld symbols

TD 14.0 — Demonstrate knowledge of metal material codes

- 14.1. Recognize and apply material codes as specified by the American Iron and Steel Institute (AISI), the Society of Automobile Engineers (SAE), the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineers (ASME), and Unified Numbering System (UNS)

TD 15.0 — 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. 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

- Solve single variable algebraic expressions.

Science Skills

- Have a basic understanding of common material properties.

Language Arts Skills

- 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
- Algebra
- Geometry
- Measurement
- 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 forces and motion
- Understands the nature of scientific inquiry

Language Arts Standards

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- 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 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 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.ncte.org/standards.