



## 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.

### ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with technical drafting as an occupational objective.

### 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 no longer 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 clothing items that are pictured and described at [www.skillsusastore.org](http://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.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee for each competitor:
  - a. Flat table space approximately 18"x72"
  - b. Chair
  - c. Access to power
  - d. Printer with toner
  - e. Paper
  - f. Internet access
2. Supplied by the competitor (These materials cannot be shared with other competitors.):
  - a. A personal computer
  - b. Battery-powered calculator (not a cell phone)
  - c. *Machinery's Handbook* and a maximum of three additional published reference books
  - d. One 6' multiple-outlet surge protector
  - e. Flash drive
  - f. All competitors must create a one-page resume. See "Resume Requirement" below for guidelines.

### 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 focus on the application of appropriate entry-level technical drafting skills to solve visualization and presentation problems of a mechanical nature, as designed by the national technical committee.

### KNOWLEDGE PERFORMANCE

The competition will include a written exam that assesses technical drafting general knowledge (see standards and competencies). 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. The number of drawings will vary depending on the product. The drawing portfolio may vary between five (5) to 10 drawings.
2. Competitor-supplied computer aided drafting and design software is used.
3. The competitors work independently. No assistance may be given by other competitors, instructors, advisors, or observers.
4. All competitors start and finish at the same time. No one is allowed to work past the competition conclusion. If competitors are waiting to print after the competition conclusion, they are allowed to print one drawing only.
5. Competitors will store all their drawings in PDF format on supplied flash drives for printing.
6. Competitors' drawings are judged relative to pre-established criteria for each drawing in the drawing portfolio. The total competition points include points from the written exam(s) and drawings.

### STANDARDS AND COMPETENCIES

The following items are included in the written exam and skill performance parts of the competition.

#### 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**

See the 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**

See the 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 monodetail, 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**

See 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**

See the 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**

See the 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**

See 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.**

See the 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 metal material codes**

10.1. 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 11.0 — Demonstrate knowledge of threaded fastener notation**

See the 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**

See the 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**

See the 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 drawing revisions**

See the ASME Y14.35 Drawing Revisions standard.

14.1. Create an appropriate revision block

14.2. Apply revision balloons

14.3. Create a document change notice (DCN)

### **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. 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/](http://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](http://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

*Source: McREL compendium of national science standards. To view and search the compendium, visit: [www2.mcrel.org/compendium](http://www2.mcrel.org/compendium).*

### **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](http://www.ncte.org/standards).*