

# TECHNICAL DRAFTING



## PURPOSE

To evaluate each contestant'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: <http://updates.skillsusa.org>.

## ELIGIBILITY

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

## CLOTHING REQUIREMENTS

### Class E: Contest Specific — Business Casual

- Official SkillsUSA white polo shirt.
- Black dress slacks (accompanied by black dress socks or black or skin-tone seamless hose) or black dress skirt (knee-length, accompanied by black or skin-tone seamless hose).
- Black leather closed-toe dress shoes.

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:** Contestants must wear their official contest clothing to the contest orientation meeting.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee for each contestant:
  - a. Flat table space approximately 24"x72"
  - b. Chair
  - c. Two 110-volt electric outlets
  - d. Flash drive
  - e. Printer with toner
  - f. Paper
2. Supplied by the contestant (These materials cannot be shared with other contestants.):
  - a. A personal computer

- b. Computer-aided drafting software that is able to create 3D models.
- c. Battery-powered calculator (not a cell phone).
- d. *Machinery's Handbook* and a maximum of three additional published reference books
- e. All competitors must create a one-page résumé and submit a hard copy to the technical committee chair at orientation. Failure to do so will result in a 10-point penalty.

**Note:** Your contest may also require a hard copy of your résumé as part of the actual contest. Check the Contest Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

## COMPUTER/SOFTWARE REQUIREMENTS

Contestants should have installed and/or set when arriving at the contest:

### 1. Network Configuration

The following network components must be installed:

- Client for Microsoft Networking
- 10/100 10-Base T Ethernet Network Interface Card (wireless not supported)
- TCP/IP Protocol

Contestants should *not* install file and printer sharing for Microsoft networks.

Contestants should be prepared to connect to a Microsoft Windows 2000 Server domain named "DOMAIN". This means the computer's workgroup name should be DOMAIN, and Windows NT, Windows 2000 and Windows XP computers should have a local user named "USER", and USER should be a member of the LOCAL ADMINISTRATOR group. (Windows Vista is not supported for this contest.)

All computers (but particularly notebooks) should be prepared to connect to a *wired* 10BASE-T network. Vista is not allowed.

## 2. **Printer Driver Information**

Hewlett Packard DeskJet 1220 Driver should be installed. This driver is available at: [www.hp.com](http://www.hp.com).

## 3. **Application Software**

The latest service packs and updates should be applied to application software before the contest. This is the contestant's responsibility. Ability to correctly plot cannot be guaranteed unless the latest service packs and updates are applied to contestant's application software.

4. It is advisable for contestants to bring their system software and the software they will be using for the contest in case they have setup trouble.

There will be technicians on the floor the day of setup to assist contestants if they need help with cables, software, drivers, etc. Contestants renting computers can get help at that time.

## **SCOPE OF THE CONTEST**

The contest 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 contest will include a written exam that assesses technical drafting general knowledge (see standards and competencies).

### **Skill Performance**

The contestants 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.

### **Contest Guidelines**

1. The contestants 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 to 10 drawings.
2. Contestant-supplied computer aided drafting and design software is used.

3. The contestants work independently. No assistance may be given by other contestants, instructors, advisors or observers.
4. All contestants start, break for lunch and finish at the same time. No one is allowed to work during lunch or past the contest conclusion. If contestants are waiting to print after the contest conclusion, they are allowed to print one drawing only.
5. Contestants will store all their drawings in PDF format on supplied flash drives for printing.
6. Contestants' drawings are judged relative to preestablished criteria for each drawing in the drawing portfolio. The total contest points include points from the written exam and drawings.

## **Standards and Competencies**

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

### **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 Y14.1-2005 Decimal Inch Drawing Sheet Size and Formats, ASME Y14.1M-2005 Metric Drawing Sheet Size and Format standards, ASME Y14-100-2013 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 Y14.24-1999 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 Y14.2-2014 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 2-D orthographic and pictorial views from 3-D computer models to create 2-D drawings**

See the ASME Y14.3-2012 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 Y14.3-2012 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 Y14.5-2009 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 2-D part views.**

See the ASME B4.1-R1999 Preferred Limits and Fits for Cylindrical Parts and ASME Y14.5-2009 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 Y14.6-2001 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 Y14.36-1996 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 A02.4-2012 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)

## Committee Identified Academic Skills

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

### Math Skills

- Solve single variable algebraic expressions.

### Science Skills

- Have a basic understanding of common material properties.

### Language Arts Skills

- Provide information in conversations and in group discussions.
- Provide information in oral presentations.
- Demonstrate use of such verbal communication skills as word choice, pitch, feeling, tone and voice.
- Demonstrate use of such nonverbal communication skills as eye contact, posture and gestures using interviewing techniques to gain information.
- 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/browse.asp](http://www2.mcrel.org/compendium/browse.asp).

### 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).