

TECHNICAL DRAFTING (VIRTUAL)



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.

Contest Clothing Notes (Apply ONLY to Virtual Competitions):

- Official SkillsUSA Competition Clothing recommended but NOT required.
- Contestant clothing options include the following:
 - Official Competition Clothing.
 - Trade Appropriate Clothing.
 - Professional Dress.
 - Business Casual.
- Clothing must meet industry safety standards.
- No identification of the contestant, school or state is allowed on clothing.
- No offensive, vulgar or inappropriate images or text are allowed on contestants clothing.
- No shorts or sleeveless shirts are allowed.
- Skirts must be at least knee-length.
- Proper Personal Protective Equipment (PPE) must be worn by contestant to meet

all state, local and school requirements due to COVID-19.

- Scoring deductions may only be given and/or disqualification of contestant if clothing safety standards are not met.

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.

EQUIPMENT AND MATERIALS

Supplied by the contestant (These materials cannot be shared with other contestants.):

1. Computer with high-speed internet capability and camera to use applications such as Zoom, Teams, etc. The minimum recommended internet bandwidth speeds for joining Zoom meetings, accessing on-demand curriculum and other online operations is 2.0 Mbps up and down. You can test your current internet speeds by following this link: www.speedtest.net. Allow the page to load and click on GO.
2. A secondary camera(s) may be required to provide judges with the ability to view contestants from different angles. Additional camera requirements will be located on the SkillsUSA website at <http://updates.skillsusa.org>.
3. A contest Proctor will be required to be on site to assist judges. A local industry expert is preferred to serve as the Proctor and shall not be an individual that has been involved with the training of the contestant(s). The Proctor will serve as the onsite "hands and eyes" for the judges. Proctor will follow instructions from the judges for safety and operations related to the competition. Proctor may be asked by judges to perform several tasks such as operating a portable camera to show specific components or steps, measure parts, or any task that will provide judges with information needed to assist in accurate scoring of the contestant's work or presentation. However, the Proctor shall not serve as a judge nor have any influence on contestant scores.
4. The contestant's instructor or advisor shall be on site to observe all competition activities to ensure a safe and healthy

competition experience for all participants. That instructor or advisor will not be allowed to interact or interfere with the competitor unless a safety issue arises that requires interaction. Any other support or interaction between the contestant and the instructor/advisor will result in disqualification.

5. All competitors must create a one-page résumé and submit an electronic copy to the technical committee chair at least seven (7) days in advance of the competition. Failure to do so will result in a 10-point penalty. Instructions for submission of the electronic résumé copy will be provided on the SkillsUSA website at <http://updates.skillsusa.org>.
6. Computer-aided drafting software that is able to create 3D models.
7. Battery-powered calculator (not a cell phone).
8. *Machinery's Handbook* and a maximum of three additional published reference books

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.

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

Note for Virtual Competitions: Contestants may not be required to perform all the standards and competencies listed in this section. However, contestants should be prepared to perform components in all areas. Prior to the competition, the technical committee may determine which standards and competencies contestants will be perform for the virtual contests. The technical committee will determine if additional information is needed for contestants prior to the competition. These changes will be posted on the SkillsUSA Championships contest update website at: <http://updates.skillsusa.org>.

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:

<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:

<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.