# MARINE SERVICE TECHNOLOGY

## PURPOSE
To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of marine service technology.

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

## ELIGIBILITY
Open to active SkillsUSA members enrolled in programs with marine service technology as an occupational objective.

## CLOTHING REQUIREMENTS
### Class D: Contest Specific — Blue Attire
- Official SkillsUSA light blue work shirt.
- Navy pants.
- Black, brown or tan leather work safety shoes (with protective toe cap).

***Note:*** Safety glasses with 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:*** Contestants must wear their official contest clothing to the contest orientation meeting.

## EQUIPMENT AND MATERIALS
1. Supplied by the technical committee:
   a. All necessary engines, engine parts, work benches, test stands, gasoline and oil, and specialized tools
   b. Industry manuals, including service and repair instruction manuals
2. Supplied by the contestant:
   a. All competitors must create a one-page résumé and submit a hard copy to the technical committee 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: http://updates.skillsusa.org.

## SCOPE OF THE CONTEST
The contest is defined by industry standards as established by the American Boat and Yacht Council (ABYC) and industry manufacturers involved in the event. Check the SkillsUSA website for updates.

### Knowledge Performance
The contest will include a written knowledge exam to assess the knowledge of marine diagnostics, service and repair of boats and personal watercraft with accessory items.

### Skills Performance
The contest includes four skill stations assessing skills in two- and four-cycle engines, outboard and stern-drive applications, and two- and four-cycle inboard troubleshooting and repair.

### Contest Guidelines
1. Contestants will be evaluated on safe work practices, cleanliness, organization skills, accuracy, speed, completion of assigned tasks, worksheets and paperwork.
2. Judging criteria and points assigned will be determined by the difficulty of the tasks assigned.

### Standards and Competencies

#### MT 1.0 — Demonstrate general shop safety practices
1.1 Establish proper shop safety tool and equipment procedures
1.2 Apply MSDS and procedures specific to the workplace environment
1.3 Recognize and use proper personnel protection related to marine service and repair procedures

1.4 Follow hazardous materials storage and disposal requirement
1.5 Set up and use precision measuring tools.

**MT 2.0 — Demonstrate knowledge and skills needed to service two- and four-cycle gasoline and diesel engines**

2.1 Distinguish the characteristics between four-cycle gasoline engines and four-cycle diesel engines
2.2 Identify two-cycle and four-cycle major engine systems, including: fuel, cooling, lubrication, electrical, intake, and exhaust
2.3 Identify basic engine components
2.4 Demonstrate knowledge of timing the camshaft to the crankshaft on a four-cycle engine
2.5 Describe the function of the crankshaft, camshaft, pistons, connecting rods, engine block, cylinder heads, and valve train
2.6 Demonstrate the ability to perform compression and leak-down testing
2.7 Demonstrate knowledge and ability to measure and correct valve lash on a four-cycle marine engine
2.8 Demonstrate knowledge of gasoline and diesel engine diagnostic software

**MT 3.0 — Display knowledge of marine industry standards related to boat systems as specified by the American Boat and Yacht Council (ABYC), the National Marine Electronics Association (NMEA), the U.S. Coast Guard and the Code of Federal Regulations**

3.1 Demonstrate knowledge of boat electrical system standards
3.2 Apply knowledge of boat fuel system standards
3.3 Understand recreational boating safety standards
3.4 Demonstrate knowledge of NMEA 0400 coaxial cable radio standards
3.5 Demonstrate knowledge of NMEA 0183 and NMEA 2000 installation standards as it applies to gateways, backbone connections, CAN-Bus hubs and termination resistors

**MT 4.0 — Exhibit knowledge of marine electrical systems**

4.1 Apply basic electrical theory, circuit design and application
4.2 Demonstrate electrical circuit knowledge and diagnostic procedures
- 4.2.1 Measure voltage drops, current flow, and resistance in a circuit or component with a digital multimeter
- 4.2.2 Apply Ohm's Law to series, parallel and series-parallel circuits
- 4.2.3 Assess battery condition

4.3 Read and use wiring diagrams and follow troubleshooting flow charts to diagnose electrical system problems

**MT 5.0 — Apply knowledge of marine fuel systems**

5.1 Identify fuel system components and their functions in the system
- 5.1.1 Disassemble, clean and replace, and adjust standard carburetor internal components associated with an overhaul
- 5.1.2 Test engine fuel flow using manufacture's procedures and test equipment, measuring both fuel pressure and fuel vacuum
- 5.1.3 Perform service procedures on fuel tanks, fuel lines, fuel filters, fuel pumps and fuel injectors
- 5.1.4 Understand the use of additives for fuel stabilization and extended storage

**MT 6.0 — Demonstrate knowledge of marine cooling systems**

6.1 Identify raw water and closed cooling system component functions on a variety of marine engines
- 6.1.1 Access and service circulating water pumps on inboard engines
- 6.1.2 Overhaul conventional raw water pumps on outboard, inboard, and jet propulsion engines
- 6.1.3 Identify the need for sacrificial anodes in raw water-cooling systems
- 6.1.4 Identify correct procedures for cooling system anode selection and replacement
- 6.1.5 Determine engine coolant condition and freeze level

protection for closed cooling systems

6.1.6 Identify heat exchanger design and service procedures

6.1.7 Determine proper thermostat operation and replacement if required

6.1.8 Pressure test cooling systems and coolant recovery container caps to locate potential leaks and proper pressure rating of potential caps

**MT 7.0 — Apply knowledge of lubrication systems**

7.1 Demonstrate knowledge of NMMA FCW standards and API SJ requirements

7.2 Determine recommended engine oil quantity and type using the manufacturer's service manual

7.3 Change engine oil and filter following the manufacturer's recommendations for the engine

7.4 Determine maintenance service intervals recommended per the manufacturer

**MT 8.0 — Exhibit knowledge of marine drive systems**

8.1 Demonstrate knowledge of the transfer of power through forward and reverse gear assemblies of a drive unit

8.1.1 Explain why gear ratios vary from one installation to another

8.2 Demonstrate the ability to measure propeller shaft runout and determine if the runout is within specification

8.3 Measure forward and reverse gear backlash per the manufacturer's procedures

8.4 Perform pressure and vacuum tests on drive units to determine seal integrity

8.5 Demonstrate knowledge of and ability to service jet pump assemblies

8.6 Perform the inspection and service jet pump cleanout access ports

8.7 Evaluate and service jet propulsion trim and reverse gates

**MT 9.0 — Demonstrate understanding of boat trailers and systems**

9.1 Properly wire a boat trailer and connect to various vehicle types

9.2 Establish trailer tongue weight and match to vehicle capacity

9.3 Service trailer wheel bearings and ensure proper lubrication

9.4 Service trailer braking systems

**MT 10.0 — Service and repair marine sanitation systems**

10.1 Identify marine sanitation system types and their application in accordance with EPA standards and regional laws

10.2 Identify pump types used in marine sanitation systems and the advantages and disadvantages of each type for a specific application

10.3 Disassemble and reassemble a typical marine head piston type pump system and replace key pump components as needed

10.4 Demonstrate knowledge of typical type-3 marine sanitation system installation including all components such as through-hull valves and anti-siphon valves

**MT 11.0 — Demonstrate knowledge of basic boat building materials and procedures**

11.1 Identify modern composite materials used in boat construction and repair

11.1.1 Identify composite cloth material types (fiberglass, Kevlar, carbon fiber) and the application of each in marine construction or repair procedures

11.1.2 Identify the characteristics of various cloth materials used in laminate construction and repair

11.2 Distinguish between three primary resin types (polyester, vinylester, epoxy) and the characteristics of each as they apply to specific applications

11.2.1 Practice safe storage and use of the various resin types

11.2.2 Recognize catalyzation procedures for the various resin types and the use of ratios and proportions for mixing of same to ensure proper curing and pot life while working

11.2.3 Identify core materials used in composite construction and the advantages/disadvantages of each type for a given application

11.3 Recognize various marine woods used in marine construction and the characteristics of each type for a specific application

#### MT 12.0 — Model proper employability skills

12.1 Communicate effectively in written and verbal form with customers relative to service procedures either recommended or performed
12.2 Demonstrate professionalism in appearance (proper attire) and work habits such as promptness and adhering to a schedule and deadlines
12.3 Identify documents that may be required when applying for a job interview
12.4 Demonstrate knowledge and ability to complete a job application
12.5 Conduct a job search

## Committee Identified Academic Skills

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

#### Math Skills

- Use fractions to solve practical problems.
- Use proportions and ratios to solve practical problems.
- Simplify numerical expressions.
- Solve practical problems involving percentages.
- Measure angles.
- Find surface area and perimeter of two-dimensional objects.
- Find volume and surface area of three-dimensional objects.
- Make predictions using knowledge of probability.
- Make comparisons, predictions and inferences using graphs and charts.
- Solve problems using proportions, formulas and functions.
- Find a slope of a line.

#### Science Skills

- Use knowledge of mechanical, chemical and electrical energy.
- Use knowledge of temperature scales, heat and heat transfer.
- Use knowledge of speed, velocity and acceleration.
- Use knowledge of Newton's laws of motion.
- Use knowledge of work, force, mechanical advantage, efficiency and power.
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices.
- Use knowledge of principles of electricity and magnetism.
- Use knowledge of static electricity, current electricity and circuits.
- Use knowledge of magnetic fields and electromagnets.
- Use knowledge of motors and generators.

#### Language Arts Skills

- Provide information in conversations and in group discussions.
- Provide information in oral presentations.
- Demonstrate use of verbal communication skills: word choice, pitch, feeling, tone and voice.
- Demonstrate use of nonverbal communication skills: eye contact, posture and gestures using interviewing techniques to gain information.
- Demonstrate comprehension of a variety of informational texts.
- Use text structures to aid comprehension.
- Understand source, viewpoint and purpose of texts.
- Organize and synthesize information for use in written and oral presentations.
- Demonstrate knowledge of appropriate reference materials.
- Use print, electronic databases and online resources to access information in books and articles.

## 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.
- 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 relationships among organisms and their physical environment.
- 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 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.