# Marine Service Technology Standards and Skills

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## Health & Safety Standards

### Standard 1: Safety and Health in a Marine Service Technology Environment

Students will demonstrate safety practices by applying safety protocols in both shop and on-the-water environments, including the proper use, maintenance, and storage of tools and equipment, effective use of personal protective equipment (PPE), and proper implementation of boating safety regulations and procedures.

* Aligned Industry Recognized Credentials: OSHA10 – General Industry, MA Boating Safety, American Boat and Yacht Council (ABYC) Entry Level Marine Technician Certification

#### Skills:

1. Identify, describe, and demonstrate the effective use of Safety Data Sheets (SDS) to meet documentation requirements.
2. Locate emergency equipment, first aid kit, and emergency action and response plan, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM).
3. Apply marine and boating safety communication procedures, ensuring adherence to regulations such as Coast Guard communication standards and international maritime communication protocols.
4. Analyze and apply marine and boating vessel safety checklists, as well as guidelines for safe navigation, and including components of the Massachusetts Boating Safety Certification.
5. Demonstrate proper marine work attire and the safe use of PPE, including insulated gloves, non-slip footwear, knee pads, earplugs, eye protection, and respiratory gear when working with hazardous materials, like fiberglass, chemicals, and paints.
6. Demonstrate the correct use of Coast Guard-approved personal flotation devices (PFDs) to ensure personal safety by consistently wearing them when working on or near water, including docks, piers, and aboard vessels.
7. Apply safe methods for lifting and hoisting boats during repairs, including pre-lift inspections, using manufacturer-identified lift points, and safely lifting, securing, and stabilizing vessels to prevent accidents or damage.
8. Demonstrate the correct procedure for safely working with electrical systems, including the implementation of lockout/tagout (LOTO) procedures to disconnect power and verify de-energization for both shop and dockside repair work.
9. Analyze the properties, applications, and risks of chemicals commonly used in marine service and implement safe handling, storage, and disposal procedures in compliance with environmental and safety regulations.
10. Demonstrate procedures for responding to fuel spills and leaks, including containment and cleanup techniques.
11. Understand and apply appropriate fire protection regulations, including NFPA 70E (Electrical Safety in the Workplace), NFPA 10 (Portable Fire Extinguishers), and NFPA 302 (Fire Protection Standard for Pleasure and Commercial Motor Craft).

## Technical & Integrated Academic Standards

### Standard 2: Role of Marine Service Technicians in Society

Students will analyze the influence of regulatory standards and advanced technologies on marine vessel performance and service, along with environmentally friendly practices that enhance industry standards and ensure compliance with state and federal regulations.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Analyze the impact of Massachusetts Department of Environmental Protection (MassDEP) regulations on innovations in mechanical and electronic systems in marine vessels, focusing on advancements that enhance performance, reduce emissions, and ensure environmental compliance.
2. Evaluate the effectiveness of advanced diagnostic software and tools in assessing the functionality and performance of modern marine systems, ensuring that repairs and maintenance align with National Marine Manufacturers Association (NMMA) guidelines.
3. Assess the effectiveness of environmentally friendly practices implemented in marine vessel maintenance and repair, including the proper management of hazardous waste in compliance with Massachusetts Hazardous Waste Regulations (310 CMR 30).

### Standard 3: Fasteners, Measuring Devices, and Tools

Students will demonstrate proficiency in the selection, use, and maintenance of hand tools, power tools, fasteners, and measuring devices essential for marine service.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Compare and contrast various types of fasteners and their applications.
2. Recognize SAE metric bolt head markings and explain their significance.
3. Identify and describe the function of common snap rings, cotter pins, retainers, nuts, washers, and lock washers.
4. **Explain the concept of fastener torque, torque sequence, the use of torque specification charts, and the application of torque angle gauges.**
5. **Describe the types of torque wrenches, demonstrate their proper use in fastener installation, and utilize torque angle gauges for precise tightening procedures.**
6. Identify and use low-precision measuring tools, such as outside and inside calipers, feeler gauges, and tape measures, for accurate and practical measurement tasks.
7. Demonstrate the proper use of both dimensional and performance measurement precision tools including hole gauges, telescoping/snap gauges, vernier calipers, inside and outside micrometers, depth gauges, dial indicators, and compression gauges.
8. Demonstrate appropriate selection and use of a variety of hand tools, including screwdrivers, pliers, wrenches, punches, chisels, hammers, and files.
9. Utilize mechanical tools such as sockets, extensions, hacksaws, thread-cutting taps and dies, and gasket scrapers, maintaining accuracy and precision in marine service applications.
10. Apply specialized tools in repair tasks, including tubing cutters, flaring tools, wire brushes, and bench vises, ensuring safety and efficiency in marine vessel maintenance.
11. Demonstrate the appropriate use and maintenance of power tools, including air impact wrenches, electric drills, soldering irons, and bench grinders.
12. Evaluate the selection of drill bits and drilling speeds, comparing their application across different metals to achieve precise results.
13. Demonstrate soldering techniques, identifying appropriate solder types and safety measures when working with electrical components to ensure proper tool handling.
14. Apply specialized tools for material and component preparation, including heat guns for heat-shrink applications, paint removal, and caulking guns for sealing joints and preventing water ingress in marine vessels.
15. Utilize electrical-specific tools, such as crimping tools for creating secure electrical connections, ensuring compliance with marine safety standards.

### Standard 4: Boat Anatomy, Dimensions, and Handling

Students will accurately identify, measure, and describe the key parts and dimensions of a boat and demonstrate boat handling skills using industry-standard terminology and methods, ensuring alignment with industry standards.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify and describe key parts of a boat, including hull, deck, bow, stern, transom, beam, draft, and keel.
2. Measure and calculate critical boat dimensions, such as overall length, beam, draft, and freeboard, using standard tools and methods.
3. Explain how understanding boat dimensions is fundamental for proper load calculations, weight distribution, and effective maintenance practices.
4. Explain the relationship between boat dimensions and performance factors such as stability, capacity, and buoyancy.
5. Interpret manufacturer specifications for lift points and weight distribution as they relate to boat maintenance and repair.
6. Demonstrate safe practices for mooring and docking, such as using appropriate lines and fenders to prevent damage and ensure safety during boarding and disembarking.
7. Demonstrate proper refueling protocols for boats, including safety precautions, use of appropriate equipment, monitoring for leaks, ensuring ventilation, and compliance with environmental regulations to prevent spills and contamination.
8. Explain protocols for situations such as man-overboard, flooding, or equipment failure to ensure safe handling in distress situations.
9. Demonstrate proper use of navigation systems and communication devices to ensure safe operation, especially in challenging conditions.

### Standard 5: Fundamentals of Core Maintenance Areas in Marine Service

Students will perform routine vessel maintenance and inspections to identify maintenance needs and execute basic service procedures, ensuring efficient and safe vessel operation.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Analyze and interpret parts and service manuals, electronic parts catalogs, and computer data to accurately determine and document the correct components needed for procurement in various marine systems.
2. Demonstrate appropriate maintenance documentation, including repair orders and invoices, to ensure compliance with industry standards and completeness of service records.
3. Conduct regular inspections of safety equipment, including life jackets, fire extinguishers, flares, and first aid kits, and evaluate compliance with Coast Guard regulations using a marine safety checklist.
4. Demonstrate inspection and maintenance of lighting systems, such as navigational lighting, to ensure functionality and safety.
5. Demonstrate the removal, repair, and installation of broken fasteners, including the installation of helicoils or similar inserts with precision.
6. Demonstrate maintenance procedures for mechanical propulsion systems, such as oil changes, filter replacements, and alignment checks.
7. Evaluate and maintain gasoline and diesel fuel systems, ensuring proper installation and preventing potential fire or explosion hazards during refueling or repair work on the water.
8. Inspect and assess the integrity of engine mounts, chocks, and alignment, making recommendations for repairs or replacements as needed.
9. Inspect and service engine components such as spark plugs, linkages, and flame arrestors, including servicing/replacing spark plugs, checking, and adjusting linkages, and servicing flame arrestors.
10. Implement preventative maintenance protocols on mechanical and electrical systems by inspecting hoses, belts, clamps, and connectors for wear and damage.
11. Inspect and service both hydraulic and mechanical steering systems, ensuring proper lubrication and functionality.
12. Conduct a thorough inspection of the hull for cracks, blisters, or signs of osmosis, and evaluate the condition of anti-fouling paint.
13. Inspect propellers for damage, wear, and proper attachment, checking shaft alignment and seals for leaks.
14. Inspect the bilge for signs of oil or fuel leaks and check bilge pumps for functionality.
15. Identify the different types of plumbing systems, including pressurized and non-pressurized systems, as well as distinctions between above-waterline and below-waterline installations.
16. Inspect the plumbing system for leaks and wear by checking hoses, valves, and fittings, ensuring all hose connections are double-clamped, confirm that vented loops are installed for hoses connected to below-waterline through-hulls, and that hard piping is "soft coupled" for flex and shock absorption.
17. Identify, evaluate, service, and maintain marine sanitation devices (MSD) as part of comprehensive waste management systems, including solid, liquid, and hazardous waste, holding tanks, and waste discharge systems, ensuring proper function and compliance with environmental regulations.
18. Describe and demonstrate proper winterizing procedures for engines, potable water, and waste systems to protect vessels from freeze damage.
19. Execute shrink-wrapping techniques for vessels, ensuring protection during storage and transport.
20. Apply cleaning, waxing, and buffing techniques to enhance boat surfaces, preparing them for routine maintenance or storage.

### Standard 6: Marine and Fuel and Lubrication Systems Maintenance and Repair

Students will evaluate, service, and repair marine fuel and lubrication systems to ensure optimal performance, safety, and compliance with Coast Guard regulations, including thorough diagnostics and appropriate responses to issues in both outboard and inboard systems.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify the components and functions of all marine fuel systems, including inboard and outboard systems and stern drive systems, e.g., carburetors, fuel lines, fuel pumps, fuel tanks, anti-siphon systems, and oil injection systems.
2. Explain Coast Guard fuel systems regulations and demonstrate the ability to troubleshoot, repair, and replace components, such as oil pumps, fuel lines, and gaskets in marine fuel and lubrication systems.
3. Evaluate the fuel ventilation systems to ensure proper airflow and prevent dangerous vapor buildup; check for obstructions and perform necessary repairs or adjustments to comply with safety regulations.
4. Evaluate marine fuels and engine oils, determine appropriate mix ratios, check fuel for contamination and degradation, and perform routine servicing.
5. Inspect fuel and exhaust system components, such as fuel hoses and clamps, and inspect exhaust systems for corrosion, blockages, or leaks.
6. Inspect and service fuel tanks for integrity, including checking for corrosion, leaks, and ensuring proper ventilation.
7. Diagnose and resolve issues with fuel delivery systems, such as identifying blockages in fuel filters or injectors, and cleaning or replacing malfunctioning components to restore proper fuel flow.
8. Conduct diagnostic tests on fuel injectors and pumps to assess their functionality and efficiency, adjusting or replacing as needed.
9. Demonstrate troubleshooting for multi-port fuel injection systems, identifying common issues and their solutions.
10. Demonstrate disassembling, cleaning, rebuilding, and reassembling outboard carburetors to ensure proper operation.
11. Diagnose and synchronize throttle linkages, checking for proper operation and adjusting as needed.
12. Inspect and repair fuel lines, filters, and tanks of outboard motors, assessing their integrity and functionality.
13. Explain the importance of maintaining proper fuel flow and pressure in inboard systems.
14. Remove, inspect, and repair inboard carburetors, ensuring all components are functioning correctly.
15. Inspect and adjust carburetor linkages and choke systems for optimal operation, identifying any needed repairs.
16. Evaluate the functionality of lubrication systems by analyzing oil pressure and flow rates, identifying irregularities, and repairing or replacing faulty oil pumps, filters, or seals to maintain engine lubrication.
17. Perform a fuel pressure test to determine the integrity of the fuel pump and pressure regulator, adjusting or replacing parts as needed to meet manufacturer specifications.
18. Implement procedures for the safe disposal of used oils and fuels, ensuring compliance with environmental regulations and promoting sustainability in marine operations.

### Standard 7: Marine Ignition Systems Maintenance and Repair

Students will demonstrate skills in maintaining, troubleshooting, and repairing marine ignition systems to enhance engine performance and reliability.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify components of the ignition system, including spark plugs, distributors, ignition coils, and control modules, to facilitate effective troubleshooting and repair.
2. Inspect the ignition systems' primary and secondary circuits, performing timing and synchronization, and ensuring proper system function.
3. Troubleshoot marine ignition systems, including stern drive and inboard systems, by inspecting primary and secondary circuits and repairing or replacing components as needed to ensure proper system function.
4. Perform voltage and resistance checks on primary ignition circuits to diagnose issues, such as short circuits or coil malfunctions, and replace or repair faulty wiring or components to restore proper ignition function.
5. Demonstrate the use of diagnostic tools, such as multimeters and oscilloscopes, to evaluate ignition system performance.
6. Demonstrate removing, repairing, reinstalling, and bench testing distributors, as well as replacing and checking control modules, to maintain optimal performance of marine ignition systems.
7. Demonstrate cleaning and adjust spark plugs, ensuring proper gap settings and replacement if necessary, to maintain efficient ignition system performance and prevent misfires.
8. Demonstrate testing and replacing ignition coils, ignition switches, and other critical components in electronic ignition systems to ensure consistent engine starting and operation under various load conditions.

### Standard 8: Marine Electrical Systems Maintenance and Repair

Students will apply service, diagnostic, and repair skills to marine electrical systems, demonstrating an understanding of basic electrical principles and theory, evaluating system performance, and maintaining and repairing components.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Explain the basic principles and theory of electrical systems, including concepts such as voltage, current, resistance, and the relationships between them (Ohm’s Law), as well as the differences between AC and DC systems.
2. Apply Ohm's Law to wire a circuit in both series and parallel configurations.
3. Interpret ABYC wiring codes, electrical schematics, and wiring diagrams to properly route, secure, and inspect connections for loose, corroded, or damaged wiring and ensuring adherence to industry standards for wire sizing, insulation, and proper installation of electrical systems.
4. Utilize diagnostic tools, including multimeters and oscilloscopes, to troubleshoot electrical issues in marine systems, such as short circuits, open circuits, and faulty grounding.
5. Inspect and assess the grounding and bonding of AC and DC electrical systems to prevent electric shock hazards, lightning strikes, and electrical fires.
6. Measure and interpret electrical measurements (voltage, current, resistance) to assess circuit performance and identify faults.
7. Demonstrate the installation of lighting fixtures, including soldering and crimping skills, to create reliable electrical connections, and apply heat shrink tubing and waterproof connectors to protect against moisture and corrosion.
8. Perform battery maintenance by checking voltage, cleaning terminals, and ensuring corrosion-free connections; diagnose and repair charging systems, including alternators and voltage regulators, to maintain battery charge.
9. Determine appropriate fuse and circuit breaker sizes based on the electrical load requirements to ensure system protection.
10. Inspect and replace damaged or tripped components, such as switches, relays, fuses, and circuit breakers, adhering to marine-grade standards.
11. Inspect sacrificial anodes regularly to prevent galvanic corrosion and apply protective coatings to prevent further metal deterioration.
12. Inspect the shore power inlet and connections to ensure they are clean and corrosion-free.
13. Identify components of electric propulsion systems, such as electric motors, batteries, controllers, and their integration with the boat's electrical system.
14. Evaluate the integration of solar energy systems and energy storage solutions into existing marine electrical systems by analyzing their impact on energy efficiency, sustainability, and overall performance.

### Standard 9: Cooling Systems Maintenance and Repair

Students will apply diagnostic and troubleshooting skills to marine cooling systems, evaluating system performance, and demonstrating the ability to maintain and repair components.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify and describe the components of marine cooling systems, including pumps, hoses, impellers, thermostats, heat exchangers, and through-hull fittings, explaining their function and role in maintaining optimal engine temperature.
2. Inspect, evaluate, and demonstrate maintenance techniques on marine cooling and exhaust systems, including components, such as pumps, hoses, impellers, thermostats, heat exchangers, and through-hull fittings, and ensuring proper coolant flow, system pressure, flow rates, impeller performance, coolant levels, heat exchanger conditions, and verifying coolant type and compatibility.
3. Diagnose and repair marine cooling systems (raw water and closed systems) for outboard, sterndrive, and inboard applications, addressing issues such as pump failures, leaks, impeller damage, thermostat malfunctions, and performing flushing and cleaning as required.
4. Perform winterizing procedures for cooling systems, including draining, flushing, and protecting the system from cold-weather conditions to prevent freeze damage during off-seasons.

### Standard 10: Marine Drive and Trim Systems Maintenance and Repair

Students will understand the theory of operation for marine drive and trim systems while demonstrating the ability to inspect, service, and repair these systems to ensure optimal performance, reliability, and safety of marine vessels.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify and describe the components of marine drive systems, including gears, drive shafts, and other related parts, explaining their functions and relationships within the system.
2. Inspect and service the drive train and gear cases, including checking fluid levels, lubricating parts, and examining for wear and damage to maintain efficient operation and prevent failure.
3. Demonstrate conducting tune-ups on stern drive, outboard, and inboard engine systems to optimize performance and reliability.
4. Apply diagnostic techniques to troubleshoot all drive system components, identifying issues to enhance reliability and performance.
5. Troubleshoot, diagnose, and repair transom plate systems and related components (including gimbal ring and bell ring), ensuring secure fit and function, enhancing drive system integrity, and preventing operational failures.
6. Diagnose, service, repair, and adjust outboard lower units, including shift systems, gears, and seals, to ensure proper operation and optimal functionality.
7. Demonstrate proper procedures for the removal and installation of stern drives.
8. Describe the impact of trim systems on various hull configurations, demonstrating an understanding of how trim adjustments influence vessel performance and handling.
9. Demonstrate repairing or replacing power trim and tilt systems, including midsections and lines, to ensure proper operation and performance.

### Standard 11: Marine Steering Systems Maintenance and Repair

Students will demonstrate the maintenance and repair of marine steering systems, including cable, hydraulic, and power-assisted types, ensuring optimal functionality and reliability in marine vessels.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify and explain the components and operation of marine steering systems, including cable, hydraulic, and power-assisted steering systems.
2. Inspect marine cable steering systems for wear, corrosion, and damage, identifying potential issues according to ABYC safety standards.
3. Service and repair marine cable steering systems, including replacing cables, adjusting tension, and lubricating moving parts to ensure smooth operation.
4. Demonstrate proper handling of hydraulic systems by checking pressure relief valves, inspecting hoses for leaks, and managing high-pressure fluid systems on steering and trim tabs to prevent injury or system failure.
5. Inspect and service marine hydraulic steering systems by diagnosing faults in system components, checking fluid levels, and ensuring proper hydraulic pressure, including tasks such as replacing seals and flushing/refilling fluids.
6. Diagnose and troubleshoot common steering system failures, including stiff steering, steering lag, and alignment issues.
7. Service and repair marine steering accessories, including helm pumps, rudder linkages, steering wheels, and other auxiliary components.
8. Test repaired steering systems for functionality and safety, ensuring proper alignment, fluid levels, cable tension, and pressure according to ABYC guidelines.
9. Perform preventive maintenance on marine steering systems, including lubrication, tightening connections, and checking alignment to prevent future malfunctions.

### Standard 12: Fundamentals of Overhaul of Four-Stroke Engines

Students will demonstrate the skills to effectively overhaul four-stroke cycle engines, utilizing specialized tools, diagnosing issues, and performing comprehensive service procedures while adhering to manufacturer specifications to ensure optimal performance and reliability in marine service technology.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Explain the basic principles of Internal Combustion Engines (ICE), including the concepts of combustion, thermodynamics, and mechanical energy conversion.
2. Identify the characteristics and operational cycles of four-stroke engines (intake, compression, power, exhaust) explaining their applications in marine technology.
3. Identify and use specialized tools for engine overhaul, such as torque wrenches, valve spring compressors, and piston ring installers, to ensure precision and safety.
4. Inspect and evaluate the cooling and lubrication systems during engine overhaul, ensuring they are clean and functioning properly to prevent future failures.
5. Conduct a thorough failure analysis and demonstrate comprehensive overhaul diagnostic and service procedures for four-stroke cycle engines, identifying root causes of malfunctions, and integrating theoretical knowledge with practical application to recommend appropriate repair strategies.
6. Demonstrate the proper disassembly and reassembly of four-stroke cycle engines, following manufacturer guidelines for alignment and torque specifications.
7. Use compression and leak-down testers to diagnose valve and head problems, interpreting results to identify necessary repairs and inspecting the cylinder head and gasket for wear or damage.
8. Remove, clean, and inspect internal engine components, including connecting rods, pistons, camshaft, bearings, and crankshaft, assessing their condition for reusability.
9. Perform precision measurements of internal engine components using appropriate tools and techniques and documenting findings accurately.
10. Measure bearing clearance using plastigauge, evaluating the results to determine the need for replacement or adjustment.
11. Demonstrate honing and cleaning cylinders, preparing them for the installation of new components.
12. Inspect crankshaft end play for run-out using appropriate measuring devices, ensuring proper engine alignment.
13. Install pistons onto piston pins, ensuring proper orientation and installation of rings, following manufacturer guidelines.
14. Install oil seals correctly, ensuring no leaks occur during engine operation.
15. Conduct final testing of the engine after reassembly, including starting the engine, checking for leaks, and performing operational tests to confirm proper functionality.
16. Demonstrate knowledge of, and adherence to, safety practices and environmental regulations when handling engine fluids and components, including proper disposal of hazardous materials.

### Standard 13: Fundamentals of Overhaul of Two Stroke Cycle Engines

Students will demonstrate the ability to overhaul two-stroke cycle engines by diagnosing issues and performing service and repair procedures in accordance with manufacturer specifications to ensure reliability and optimal performance.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Identify the characteristics and operational cycles of two-stroke cycle engines, including their applications in modern marine technology and the impact of emissions regulations.
2. Explain the function of each component within the two-stroke cycle engine and its role in overall engine performance, including advancements such as direct fuel injection and electronic ignition systems.
3. Diagnose combustion chamber issues using compression testing methods and interpret results to determine necessary repairs while employing computer diagnostic tools as applicable.
4. Remove, clean, and inspect cylinder heads for cracks, warping, and damage to spark plug threads, assessing their condition for reusability and adhering to safety protocols.
5. Inspect, clean, and measure internal engine components such as pistons, connecting rods, crankshaft, and bearing surfaces, identifying any wear or damage, and determining the need for replacement.
6. Demonstrate honing and cleaning cylinders to prepare them for reassembly, ensuring proper surface finish and clearances that meet manufacturer specifications.
7. Inspect and clean the intake manifold, checking and replacing reed valves as necessary to ensure optimal air/fuel mixture and performance, while following best practices for handling engine fluids.
8. Reassemble the engine according to factory specifications, ensuring all components are aligned, torqued, and installed correctly, and considering the importance of preventive maintenance.
9. Conduct performance testing after reassembly, including checking for leaks, measuring engine output, and confirming operational parameters to ensure the engine operates efficiently and safely.
10. Demonstrate knowledge of, and adherence to, safety practices and environmental regulations when handling engine fluids and components, including proper disposal of hazardous materials.

### Standard 14: Marine Diesel Engine Technology

Students will demonstrate the ability to analyze and apply maintenance procedures for marine diesel engines, ensuring optimal performance, reliability, and compliance with industry standards.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Describe the principles of operation of marine diesel engines, including thermodynamic cycles and energy conversion processes.
2. Identify and explain the functions of key components in marine diesel engines, including turbochargers, intercoolers, and superchargers.
3. Differentiate between two-stroke and four-stroke diesel engines by explaining their operational characteristics and applications in marine settings.
4. Identify and describe internal engine components, such as pistons, cylinders, crankshafts, and camshafts, and their respective roles in engine operation.
5. Evaluate and establish adequate ventilation in enclosed spaces where diesel engines operate to prevent the accumulation of harmful fumes.
6. Demonstrate knowledge of and follow established protocols for safely starting and shutting down diesel engines to prevent accidents and equipment damage.
7. Perform a compression test on marine diesel engines to assess engine health and diagnose potential issues.
8. Inspect and service the valve train components, ensuring proper alignment and functionality.
9. Explain and troubleshoot diesel fuel systems, including fuel pumps, injectors, and filters, identifying common issues and their solutions.
10. Demonstrate proper handling and storage techniques for diesel fuel to prevent spills and leaks, ensuring compliance with safety regulations.
11. Change fuel filters and bleed the fuel system, ensuring that air is removed and the system operates efficiently.
12. Identify and explain the lubrication system in marine diesel engines, including oil types, filter systems, and oil change procedures.
13. Identify and explain the components of the electrical system specific to marine diesel engines, including starter motors, solenoids, and circuit breakers.
14. Diagnose, service, and repair the electrical system of marine diesel engines, including battery checks, alternator functionality, and wiring integrity.
15. Inspect and maintain the exhaust system to ensure proper venting of fumes away from the boat, identifying any leaks, and taking corrective action.
16. Check the cold start system, including glow plugs and starter motor operations, to ensure reliable engine starting in low-temperature conditions.
17. Identify and use appropriate fire extinguishers for flammable liquid fires, demonstrating knowledge of fire prevention measures around diesel engines.

### Standard 15: Fundamentals of ARC, MIG, and TIG Welding

Students will demonstrate the ability to apply welding techniques in the maintenance, repair, and fabrication of marine vessels and components, adhering to industry and OSHA safety standards.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Evaluate material compatibility for welding in marine environments, ensuring the proper selection of welding techniques and filler materials for marine-grade metals such as aluminum and stainless steel.
2. Describe and implement fire and explosion prevention measures, including ventilation, and using spark-resistant blankets to reduce risks during welding on or near marine fuel systems or confined spaces.
3. Demonstrate proper electrical grounding and bonding techniques for welding equipment, preventing electrical hazards in marine environments.
4. Explain the principles and applications of ARC welding, identifying its role in marine service operations.
5. Demonstrate ARC welding techniques in multiple positions (horizontal, vertical, overhead), using various welding rods and ensuring the correct application for different marine materials.
6. Inspect and troubleshoot common ARC welding issues, such as improper penetration or cracking, and recommending corrective measures based on inspection.
7. Explain the principles and advantages of MIG welding in marine fabrication and repairs.
8. Demonstrate MIG welding techniques in various positions (flat, vertical, overhead), adjusting machine settings and applying welding methods suitable for different marine-grade materials.
9. Evaluate MIG welds for strength, cleanliness, and compliance with marine safety standards, diagnosing any defects.
10. Explain the function and applications of TIG welding in high-precision marine work, especially on aluminum and stainless steel.
11. Demonstrate TIG welding techniques in various positions (flat, vertical, overhead), using A/C and D/C electricity, ensuring correct settings for different metals used in marine environments.
12. Analyze TIG welds for porosity, discoloration, and defects, providing solutions for correcting substandard welds in marine applications.
13. Apply corrosion prevention techniques after welding, including cleaning, anti-corrosion treatments, and coatings appropriate for marine vessels to ensure long-term structural integrity.
14. Demonstrate testing techniques for weld integrity, such as performing a dye penetrant test or visual inspection to detect defects and ensure that the welds meet ABYC standards for safety and reliability in marine conditions.
15. Identify procedures for protecting sensitive onboard electronics during welding operations, including isolating or shielding equipment from potential interference or damage.
16. Explain and demonstrate the safe operation of a plasma cutter, detailing its uses in marine metal fabrication and repair.
17. Demonstrate proper setup and cutting techniques with a plasma cutter on various metals commonly used in marine vessels, ensuring smooth and accurate cuts.
18. Explain the functions and safe operation of oxygen/acetylene torches in cutting and welding applications within the marine service industry.
19. Demonstrate lighting, heating, and cutting operations with oxygen/acetylene torches, adhering to OSHA safety standards and marine industry practices.
20. Perform safety checks and maintenance on welding and cutting equipment, ensuring they meet industry and safety standards for marine operations.
21. Describe and apply appropriate procedures for storing, handling, and disposing of welding and cutting materials in compliance with OSHA and marine safety regulations.

### Standard 16: Fundamentals of Boatbuilding and Repair

Students will demonstrate the ability to select appropriate materials, including sustainable options, tools, and techniques for the repair and construction of boats, while adhering to industry, environmental, and quality standards.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Explain the fundamental principles of boat design and structural integrity, focusing on load distribution, buoyancy, and the impact of various forces acting on a vessel.
2. Evaluate and select sustainable materials for boat construction and repair by considering their environmental impact, resource availability, lifecycle assessment, and practical applications, e.g., bamboo, lightweight composites, recycled plastics, sustainably sourced wood, cork, biobased resins, and natural fiber reinforcements.
3. Analyze the physical and chemical properties of marine-grade woods, metals, and composites, including their strengths, weaknesses, and suitability for various marine applications.
4. Identify and describe the characteristics and functions of marine-grade woods, metal, and composites such as fiberglass materials, chemicals, and tools used in boatbuilding and repair.
5. Evaluate various wood treatment methods to enhance durability and moisture resistance, demonstrating application techniques for preservation and maintenance in marine environments.
6. Demonstrate basic metal fabrication skills, including cutting, welding, and finishing techniques, while adhering to safety protocols and industry standards.
7. Compare and contrast the characteristics of polyester, vinylester, and epoxy resins including their applications and limitations in marine environments.
8. Demonstrate proper safety protocols when handling fiberglass materials, including appropriate personal protective equipment (PPE), ventilation, and fire prevention measures.
9. Explain the step-by-step process of gel coat application and perform basic maintenance and repair of gel coat surfaces.
10. Demonstrate laminating procedures using fiberglass and resin, ensuring proper saturation, and alignment of layers ensuring structural integrity.
11. Inspect cured fiberglass laminates and perform secondary repairs on areas that show wear, cracking, or structural weaknesses.
12. Describe and demonstrate the process of plug and mold construction, including the use of release agents and mold maintenance.
13. Analyze and apply corrosion prevention techniques after fiberglass repairs using appropriate cleaning and anti-corrosion treatments.
14. Explain the environmental and health implications of fiberglass work and demonstrate sustainable practices such as waste minimization and proper disposal of hazardous materials, adhering to both OSHA guidelines.
15. Perform a final inspection on completed fiberglass repairs and boatbuilding projects using visual and physical testing methods to ensure that they meet industry standards for structural integrity and safety.
16. Demonstrate proper storage, handling, and compatibility testing of fiberglass materials, ensuring that all materials are for marine use.
17. Conduct non-destructive testing (NDT) on fiberglass repairs and laminates to evaluate their integrity and adherence to industry standards.

### Standard 17: Servicing Boat Trailers

Students will demonstrate the ability to service and maintain boat trailers while adhering to industry best practices and safety protocols.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Evaluate the structural integrity and functionality of various types of boat trailers, including identifying common defects and determining necessary repairs.
2. Identify the components of boat trailers, e.g., axles, tires, brakes, hitch systems, and requirements of a comprehensive maintenance schedule tailored to trailer types.
3. Demonstrate trailer maintenance procedures, such as tire rotation, bearing lubrication, and electrical system checks, evaluating the effectiveness of each procedure against established benchmarks.
4. Demonstrate proper techniques for servicing trailer brakes, including inspection, adjustment, and replacement of components.
5. Assess the effectiveness of different types of trailer hitches and couplers, considering factors such as weight capacity, towing stability, and compatibility with various boat types.
6. Integrate knowledge of load distribution and balance to formulate recommendations for trailer modifications or upgrades that improve towing performance and safety.
7. Reflect on the importance of environmental considerations in trailer servicing, such as proper disposal methods for hazardous materials and compliance with local regulations.

## Employability Standards

### Standard 18: Employability Skills

Students will demonstrate professional communication, critical thinking, problem-solving, professionalism, teamwork, and collaboration skills within the Marine Service industry.

* Aligned Industry Recognized Credentials: ABYC Entry-Level Marine Technician Certification

#### Skills:

1. Demonstrate effective communication and positive people skills to provide exceptional customer service across various platforms, including face-to-face interactions, telephone conversations, written, and electronic correspondence.
2. Apply industry-standard terminology in written and verbal communication regarding boat anatomy.
3. Demonstrate the ability to effectively communicate technical findings and maintenance recommendations to customers or supervisors, ensuring clarity and understanding of the work performed and future maintenance requirements.
4. Demonstrate active listening skills by giving full attention to others, taking the time to understand their points, and asking appropriate questions to meet job expectations.
5. Implement effective solutions and follow-up procedures to resolve conflicts promptly, ensuring that customer concerns are addressed, and their expectations are managed.
6. Demonstrate the ability to work effectively in teams to achieve common goals by sharing technical information and coordinating with other professionals to support efficient operations.
7. Evaluate individual and team performance against established Key Performance Indicators (KPIs) to assess effectiveness and identify areas for improvement.

## Entrepreneurship Standards

### Standard 19: Entrepreneurship

Students will be able to describe opportunities for entrepreneurship and be able to evaluate the value proposition of business ownership in the Marine Service industry.

#### Skills:

1. Evaluate the licensing, regulatory, and tax implications of self-employment and business ownership in the marine service technology industry, in comparison to W-2 employment.
2. Understand current job trends, skill requirements, and potential growth areas within the marine service technology field, focusing on maintenance, repair, and marine systems technology.
3. Assess the impact of technological advancements on business opportunities and strategies in marine service technology, including the integration of new tools, software, and diagnostic equipment, and how these innovations can enhance business growth and operational efficiency.

## Digital Literacy Standards

### Standard 20: Digital Literacy

Students will demonstrate digital literacy skills essential for the Marine Service Technology field, including the use of diagnostic software, data management, technical documentation, and digital communication, to effectively perform modern marine service, maintenance, and repair projects.

* Aligned Industry Recognized Credentials: Entry-Level Marine Technician Certification

#### Skills:

1. Demonstrate communicating and collaborating digitally with team members, customers, and suppliers using email, messaging apps, and video conferencing tools.
2. Utilize specialized software for engine diagnostics, design, and repair, inventory management, and customer relationship management (CRM).
3. Manage and record diagnostic and service data electronically, including using databases and software for tracking maintenance schedules and parts inventory.
4. Access and interpret digital technical documentation, such as service manuals and schematics, and use online resources for up-to-date information.
5. Explain cybersecurity measures necessary to protect sensitive information and systems in a marine service environment, as recommended by industry standards.